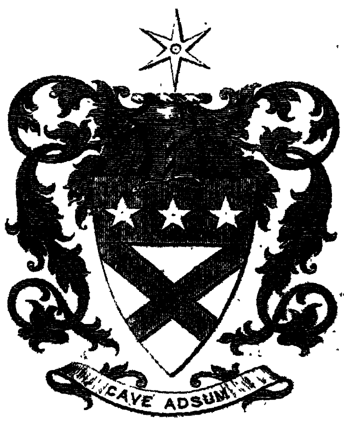
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AGRICULTURAL RESEARCH INSTITUTE

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TRANSACTIONS

OF THE

HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

JULY 1855—MARCH 1857.

III Ser.
Vol. VII.

NEW SERIES.

WILLIAM BLACKWOOD & SONS, EDINBURGH,
AND 37 PATERNOSTER ROW, LONDON.
MDCCCLVII.

CONTENTS.

TRANSACTIONS

OF THE

HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

PRELIMINARY NOTICE.

It is the duty of the Directors, in conformity with preceding practice, to prefix to the opening number of each volume of the Transactions a brief narrative of the Society's proceedings during the last two years; and, if the steady progress and continuous prosperity of the Society have hitherto permitted their predecessors to discharge this duty in a satisfactory manner, the Directors feel assured that, at no former period, could the position of the Society have been reported on, under circumstances more favourable than those by which its course has been marked, since the date of the last preliminary notice.

Seventy years have elapsed since the establishment of the Society—a period within which many other associations have risen and disappeared—but, notwithstanding the fluctuations incidental to such an institution, the Society has year after year gathered strength, and now, it is believed, exhibits more vitality and greater resources than at any former period of its history.

Its list of members may be accepted as the best criterion of this.

In	1849	the roll contained	the names	of	2688	Members.
„	1851	„	„	„	2775	„
„	1853	„	„	„	2858	„
„	1855	„	„	„	3138	„

It is not only gratifying to observe this yearly accession of numbers, but it is equally satisfactory to know that it includes a far larger proportion of tenant-farmers than was formerly the case. The Directors hail with pleasure the disposition evinced by the practical

Agriculturists of the country to avail themselves of the facilities of entrance lately conferred on them, and they believe that the influence and utility of the Society cannot fail to be enhanced by their adhesion.

GENERAL SHOWS.—The interest taken by the public in this important department of the Society's proceedings exhibits a gratifying revival. These Shows have been in operation for above thirty years, and have been repeatedly held in all the principal districts: their frequent recurrence appeared at one time to have a tendency to render the public less ready to appreciate their advantages, and this apparent indifference was perhaps increased at the time by a temporary depression in Agriculture. In 1848 the Directors found themselves, for the first time, without such applications as enabled them to continue Annual Meetings, and the subject having been submitted to the special consideration of the Society, it was resolved by the General Meeting, in July 1848, to hold the Shows triennially. The Directors, at the same time, explained that this alteration was owing, not to any change of opinion on their part as to the advantages conferred by Annual Shows, but simply to the circumstances in which the Society found itself placed, and that, notwithstanding the new regulation, requisitions for Meetings at intervals shorter than three years would readily be entertained.

The triennial system never came into actual operation, the Directors having been enabled to hold Shows biennially at Glasgow, Perth, and Berwick, while they have now the satisfaction of reporting that there is every probability of Meetings taking place during each of the next four years. The preliminary arrangements for a Show at Inverness in 1856 have been completed; one at Glasgow in 1857 has been determined on; a requisition for 1858 has been received from the Aberdeen district; and there will be no difficulty in arranging a fourth in succession at Edinburgh in 1859. In these circumstances, the Directors have no reason to regret the change made in 1848, which, though in itself little more than nominal, has served to resuscitate the public interest in the Shows, and to produce so marked a recognition of the advantages attending their annual recurrence.

SHOWS OF FAT STOCK.—In compliance with a desire generally expressed, the Society, at its General Meeting in January 1853, resolved to institute Winter Exhibitions for fat stock, poultry, dairy produce, and roots and seeds, to be held alternately in Edinburgh and in Glasgow. As no sum could be allocated for such a purpose out of the ordinary funds, without withdrawing encouragement from other objects which cannot be superseded; and as local subscriptions, such as at long intervals are raised in aid of the General Shows, could not be expected every alternate year, it was obvious that these Shows would have to be self-supporting, by producing, in fees of entry for stock, &c., and in money taken at the gates of the Yard, means sufficient to defray the premiums

awarded and the expenses incurred. The Directors were not confident as to such a result, but they considered it to be the duty of the Society to give the project a fair trial, and practically to test how far effect could permanently be given to it. Two Shows have accordingly been held, but the anticipations entertained by their promoters have, unfortunately, not been realised. The first took place at Edinburgh, in December 1853. Considering the shortness of the notice given, the stock—more particularly the cattle—in quality and in numbers exceeded expectation, and reflected much credit on the competitors. The Exhibition, however, excited no interest on the part of the general public, and but little even among agriculturists, and so meagre was the attendance, that, notwithstanding the strictest observance of economy, there was a serious difference between the receipts and expenditure, which had to be provided for out of the funds of the Society.

The Directors, unwilling to accept this unsatisfactory result as conclusive, and trusting to a greater success at Glasgow, immediately announced a similar meeting there for 1854. On this occasion the notice was ample, and every step was taken calculated to attract public attention to the Meeting. The results, however, were such as to compel the Directors to conclude that such Shows cannot be maintained, and that the interests of the Society required their abandonment. As an Exhibition, the Glasgow Show fell short of that at Edinburgh, while financially it was most unfortunate, producing a deficit of above £500. This, coupled with the apathy evinced, the impossibility of reducing the outlay, and the absence of all prospect of augmenting the receipts, compelled the Directors to recommend the discontinuance of such meetings, which was finally determined at the General Meeting in January last.

AGRICULTURAL STATISTICS.—During the last two years the Society has successfully carried out perhaps the most important and onerous undertaking ever attempted by it. The publicity already given to the various proceedings under the Agricultural Statistics Inquiry renders it unnecessary here to recapitulate them. The Directors may, however, take credit to the Society for having been instrumental in accomplishing that which for many years had been the aim of different Administrations, and of establishing the practicability of obtaining correct information respecting the Statistics of Agriculture. They can further claim for the Society the merit not only of having devised and organised the requisite machinery for this purpose, but of having successfully worked it—first, in the three counties of Roxburgh, Haddington, and Sutherland, and latterly over the whole of Scotland. The Directors would take this opportunity of reiterating their expression of the obligations under which the Society lies to the tenant-farmers of Scotland, for the liberal and enlightened manner in which they responded to the appeal made to them, and in particular to that

large section of their number who so efficiently co-operated in conducting the inquiry as enumerators, or members of district committees. While the measure would necessarily have failed without the general concurrence of Agriculturists, and though to them its success is therefore mainly attributable, it is nevertheless creditable to the position and character of the Society, that it should have been intrusted by Government with the charge of so important an investigation, and its success proves the extent to which the Society has acquired the confidence of the public, and the influence which it has the power of beneficially exercising. The Society having been requested by Government to continue the inquiry, arrangements are now being completed for doing so, and an appeal will again be made to the public spirit of the Scotch farmers, which the Directors confidently believe will not be unsuccessful.

Museum.—An important alteration is now in progress in reference to the Museum, which, it is hoped, will render the Institution more attractive, and at the same time relieve the Society of a growing difficulty. Under the original arrangement, the establishment contemplated four sections,—Implements, Geology, Vegeable Products, and Paintings of Animals. It soon became apparent that this range was too extensive, and involved, if properly worked, an expenditure which the Society could not afford. When the rooms were opened in 1841, they contained a good assortment, in model, of the most approved implements and machines used in agriculture; but it was ere long found that these required constant additions, illustrative of all new inventions and improvements, to an extent which the funds of the Society did not warrant the Directors in supplying. Accordingly, in 1851, when the Museum was injured, and its contents partially destroyed by fire, the collection of models had in some measure become antiquated, and it was resolved to apply the sum recovered under policies of insurance in the acquisition of articles of more recent date. As the means of doing so were accidental, and the relief, therefore, of a temporary character, the Directors foresaw that the difficulty would recur; but, before much progress had been made in restoring the collection, the Industrial Museum, since instituted by Government, was projected. The Society took the lead, among public bodies, in urging its establishment, and offered to transfer to Government its collection of agricultural models, and of geological specimens, on condition that the Institution should be founded in Edinburgh. After much negotiation this was accomplished, and, accordingly, these articles will be immediately transferred to the custody of the Board of Trade, for removal to the Industrial Museum.

To replace the articles thus removed, the Directors have arranged with Messrs Lawson for a complete collection, illustrative of the vegetable products of the country in all their branches.

This collection will be instructive and attractive, and will possess the advantage of requiring but little annual outlay for maintenance after the original cost has been defrayed; it will be similar to what Messrs Lawson are preparing for the Palace at Sydenham, and to that which they have completed under a Government Commission for the Paris Exhibition, and will comprise the following sections:—

1st. *Plants cultivated for their Seeds and Straw.*—To be illustrated by a small sheaf and specimen of grain, together with the manufactured products, as flour, bran, &c. The leguminous plants of this section to be illustrated by wax models.

2d. *Plants cultivated for their Herbage and Forage.*—To be illustrated by dried specimens and seeds, with a series of botanical preparations and drawings.

3d. *Plants cultivated for their Roots.*—To be illustrated by wax models of each species and variety; and, where necessary, drawings or specimens of the plants themselves—the products to be added from time to time as they can be prepared.

4th. *Plants cultivated for their Uses in the Arts and Manufactures.*—To be illustrated by dried specimens, models, or drawings, of the plants, seeds, and manufactured products.

5th. *Plants cultivated for their Timber, Bark, &c.*—To be illustrated by specimens of the trees, seeds, and sections of the wood.

Local Shows.—The Directors, appreciating the extent to which Local Shows are instrumental in agricultural improvement, have made it their special endeavour to continue and enlarge that system of District Competitions, and of connection with District Associations, which has so long constituted a leading feature in the Society's proceedings. By means of the premiums and medals offered in different localities, not only is improvement promoted in the breeding of cattle, the quality of grain, the management of root crops, the ploughing of land, and in almost every other section of agricultural operations, but the finances of the smaller Societies are supplemented, and the efforts of all are directed into proper channels, while the regulations and practice of the Society are brought to bear upon their proceedings, thus gradually extending over the country, to a certain extent, a uniformity of object and of action. Further, to the connections thus formed, and to the friendly relations established by them, is mainly to be attributed that widely disseminated influence, which has enabled the Society successfully to undertake measures such as the Statistical Inquiry.

Premiums.—The annual publication of a Book of Premiums, and the advertisements which have appeared in the public newspapers, render it unnecessary for the Directors to enter into any detailed explanation in reference to the manner in which they have employed the funds intrusted to their care. It may be sufficient to state, that in addition to the sums allocated for the General and the Winter Shows, and for the local competitions of all descriptions, it has been the aim of the Directors to promote the other objects of the Society, and generally to encourage the progress of agriculture, in its scientific as well as its practical relations, by a judicious arrangement of premiums on a scale as liberal as warranted by the state of the funds at their disposal.

VETERINARY COLLEGE.—The Directors are enabled to report the continued prosperity and utility of this establishment; and they consider it right to express the obligations due by the Society, and by the public at large, to Professor Dick, whose professional ability, zeal, and energy, with the co-operation of the able colleagues whose services he has secured, have acquired for the Edinburgh Veterinary School a celebrity not confined to this country, as is exemplified by the number of English, Irish, and Foreign candidates for the Society's diploma, which continues to be recognised by Government as a passport to the public service. It is right to add that the value of this diploma and the character of the College are materially enhanced by the manner in which the examinations are conducted by the leading members of the Medical Faculty in Edinburgh, and the most eminent veterinarians, both military and civil. The Directors have to express their regret that the health of Professor Goodsir, the Chairman of the Veterinary College Committee, has for the last two years deprived the Society of his valuable assistance; and they would avail themselves of this opportunity to thank Captain Falconar for the efficient manner in which he has presided over the Examinations in the absence of the Professor.

THE CHEMICAL DEPARTMENT continues to be superintended by Professor Anderson in his Laboratory at Glasgow. Detailed statements of the work performed there have been periodically made by the learned Professor at each of the General Meetings of the Society, and need not now be recapitulated. The rates regulated by the Society, at which members can apply to the Professor for analysis, &c., and instructions in reference to the mode of transmitting samples of different substances for examination, are appended to the Book of Premiums, and will be communicated by the Secretary to any member applying for them.

THE MONTHLY MEETINGS continue to be successfully maintained, and to form a valuable and leading section in the Society's proceedings. One important advantage resulting from them presents itself in the extent to which the principal local associations have followed the example of the Society, and the spirited and successful manner in which they have instituted and carried on discussions of a similar character.

FINANCE.—The financial position of the Society is entirely satisfactory. The inroad which, in 1846, was made on its capital, has been more than repaired, and the Directors have annually been enabled to carry to the permanent fund a sum considerably larger than that portion of the life compositions required by the by-laws to be invested. The Directors consider it not improbable that the fixed income of the Society arising from capital may, ere long, be sufficient to provide for the fixed expenditure required for the establishment. When this occurs, it will be for the Society's consideration whether further accumulation will be necessary, and if

the entire payments by members may not be applied in extension of the premium lists.

ESTABLISHMENT.—The Directors have to report no changes in the establishment, beyond the fluctuations provided for by the Charter, and they have to express their satisfaction with the manner in which the different Officers of the Society have discharged their duties. To the Secretary of the Society, Mr Hall Maxwell, the thanks of the Directors are especially due, not only for the very efficient manner in which the general arrangements of the Society have been carried into effect, but also for the zeal and ability with which he has superintended the inquiry into the Agricultural Statistics of Scotland, to which allusion has already been made. To Mr Hall Maxwell's exertions the marked success of the inquiry has been in a great measure owing. Of the importance which the Directors attach to the knowledge thus acquired of Scottish Agricultural Statistics, they have already expressed their opinion; and they have reason to believe that that opinion is shared by the great majority of those who, having occasion to make use of the information so obtained, are best qualified to appreciate its value.

ESTABLISHMENT FOR 1855.

PRESIDENT.

HIS GRACE THE DUKE OF HAMILTON AND BRANDON.

VICE-PRESIDENTS.

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THE EARL OF WEMYSS.
THE MARQUESS OF STAFFORD.
LORD LOVAT.

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SIR ARCHD. ISLAY CAMPBELL of Succoth, Bart., M.P.
THE LORD PROVOST of Glasgow.
ALEX. BAILLIE COCHRANE of Lamington.
SIR GEORGE DUNBAR of Hempriggs, Bart.
SIR JAMES MATHESON of Lews, Bart., M.P.
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CHARLES LENNOX CUMMING BRUCE of Roseisle, M.P.
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JOHN DUDGEON, Almondhill.
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George Falconar, Foxhall.
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John Learmonth of Dean.
James Tytler of Woodhouselee.
John A. Stewart Nicolson of Carnock.
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William Stuart Walker of Bowland.
The Earl of Dalkeith, M.P.
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Robert Dundas of Arniston.
Peter M'Lagan, younger of Pumpherston.
Alexander Henderson, Longniddry.
John Wilson, Professor of Agriculture in the University of Edinburgh.
Sir Robert Keith Arbuthnott, Bart.

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Sir John Stuart Forbes of Pitsligo, Bart., *Honorary Secretary.*
John Hall Maxwell of Dargavel, *Secretary.*
Rev. James Grant, D.D., & D.C.L., *Chaplain.*
Thomas Anderson, M.D., Prof. of Chemistry in the University of Glasgow, *Chemist.*
Archibald Horne, *Auditor of Accounts.*
William Blackwood and Sons, *Publishers.*
Neill and Company, *Printers.*
Charles Lawson, *Seedsman and Nurseryman.*
William Dick, *Professor of Veterinary Surgery.*
James Mackay, *Silversmith.*
Alexander Kirkwood, *Medalist.*

CHAIRMEN OF STANDING COMMITTEES.

Argyll Naval Fund,	Alexander Lamont of Knockdow.
Chemistry,	William Gregory, M.D., Professor of Chemistry in the University of Edinburgh.
Cottages,	Robert G. Baillie of Culterallers.
District Shows,	Robert Maclachlan of Maclachlan.
Finance,	Anthony Murray of Dollerie.
General Shows,	Donald Horne of Langwell.
Geology,	David Milne Home of Wedderburn.
House and Buildings,	James Anstruther, Moray Place.
Machinery,	John Miller of Leithen.
Museum,	John Hutton Balfour, M.D., Professor of Botany in the University of Edinburgh.
Premiums,	David Low of Laws.
Publications,	Alex. Forbes Irvine, younger of Drum.
Veterinary College,	John Goodsir, Professor of Anatomy in the University of Edinburgh.

MONTHLY MEETINGS.

The Duke of Buccleuch, *Chairman.*
Sir A. C. Gibson-Maitland, Bart.; Sir John M'Neill, G.C.B.; David Low of Laws; and David Milne Home of Wedderburn, *Deputy-Chairmen.*

REPORT ON THE GENERAL PRINCIPLES OF RECLAIMING LAND.

By Mr Thomas F. Jamieson, Longley Cottage, Ellon, Aberdeenshire.

[Premium—Twenty Sovereigns.]

The improvement of waste land is a subject which, for many years back, has strongly occupied the attention of the more enterprising agriculturists of Scotland; and it may reasonably be hoped that from the experience and observation of the past some guiding principles may be deduced which will serve to direct with better and surer effect the labours of the future. It embraces within its scope all the means by which land that has been hitherto sterile or unprofitable may be rendered productive and valuable.

Two classes of ground at once present themselves; 1st, That which is adapted for being brought into cultivation; 2d, That which is only suitable for planting. It is to the former description of land that we shall in the following report direct our attention, and we shall treat in detail of the different operations necessary for its reclamation from a waste state, describing the modes most advisable under different conditions of soil and situation, giving the results of our own experience and observation, and the principles to be kept in view in carrying on the proceedings.

In entering upon the improvement of any considerable tract of ground, perhaps the first thing that ought to engage attention is

Shelter.—If the position be bare or exposed, it will conduce much to the value of all the subsequent operations, that, before anything else is done, a good-sized plantation be formed on those sides from which the cold and stormy winds blow. It will add an inch or two to the height of every stalk of corn, and to the girth of every ox within the influence of its enfolding wings. Let the land for grass-parks, and it will put a pound or two of more rent on every field which lies within the bosom of the wood. We have been able to keep the ploughs at work on the south side of a plantation about 100 yards broad, when on the other side they could not go for frost. The error will rarely lie in planting too largely: let there be at least 100 yards in breadth; but should there be a general absence of woods or shelter in the district, the extent ought to be greatly increased; the bleaker and more bare the locality, the broader and thicker should the plantation be. The benefits of a large mass are various. In the first place, the trees come up much faster, as they shelter one another; and after they do come up, the benefit is much more decided to the land so protected: the individual trees attain a much more valuable size; the expense of enclosing is proportionally smaller; and the whole result is more profitable to the proprietor. In fact, unless the plantation be large, it will, in bare exposed situations, come to

nothing, and only make the bleakness of the locality more felt and visible; witness the many stunted miserable belts of the pine tribe to be seen in low bleak districts. If a plantation is to be made, let it be done as soon as possible—the first thing: it will be growing during the time the rest of the improvements are going on, and its benefits will be beginning to tell by the time they are completed. In clearing whinny ground with a view to future planting, or merely to get rid of the whins, instead of burning or rooting them up, we have found it a better plan, where they were thick, to cut them down with hedge-bills, and leave them on the surface: there they soon perish and waste away, and, in doing so, rot out the parent stocks. Burning only causes them to come up with renewed vigour; and holing them out is expensive, and is, besides, not so effectual a cure.

After having had an eye to the shelter, the next object should be the

Lines of enclosure and fences, as the laying-off of them affects a great many of the subsequent operations. Where they will not interfere with more important considerations, the lines should be straight, and at right angles to each other; straight fences being the shortest and cheapest, and square fields the most economically wrought. If possible, let them run with the slope of the ground, or right across it, as the ridges will then be got parallel to the sides of the fields, which ought all to communicate as favourably as possible with the roads in the vicinity, and the ends of as many as can be got touch the streams or water-courses of the locality. With regard to the material of which the fences are to be composed, if the ground to be improved abounds much in boulders, a double dry-stone dike will be the best. They make a complete fence at once, are easily kept, and take up little room: it will add much to their durability to have the coping-stones bedded and pointed with lime. Care should be taken to keep out all stones that have a tendency to disintegrate, and small round boulders; the interior should be well packed with small stones, and all the exterior stones laid on their flat sides, with the joints properly broken, and attention paid that the foundation be kept of sufficient breadth, which for a 4½-feet or 5-feet dike should be about 3 feet. It will also have to be observed that the carters mix them properly in the laying of them down, otherwise the large and the small will frequently be in wrong proportions. If the stones are mostly large rough blocks, a cheap fence may be constructed by piling them up above each other, wedging them together in a rough manner. Where this is well done, they stand a long while, as the weight and size of the blocks prevent them from being easily displaced. Sunk fences we do not like: in the first place, if properly sunk, they are expensive to make; then they take up a great deal of space, and do not make a complete fence, even from the inside,

without a bar of paling on the top. They give no shelter to the field; and if the ground be wet, the ooze of water behind them is apt to make the wall bulge out and come down. Rabbits also lodge and nestle in the foot of them. In a moist moorish soil the slopes of the ditches are very troublesome to keep from slipping and running down into the bottom: we have cured this, however, by carrying a drain deeper than the ditch alongside of it. These slopes will seldom grow grass without being laid with turf; cattle are very much given to standing about them, and prevent a sward from forming. Sunk fences should be about 5½ feet high, including cope, and built with a good batter, say 3 or 4 inches. The slope of the ditch should vary according to the dryness and firmness of the soil, and the width from the lip of the ditch to the cope of the dike may be from 8 to 10 or 11 feet. They answer best by the side of a wood, or on a rising bank, where they face the low ground. Stone fences should not be proceeded with in winter, as it is impossible to handle the materials with effect during cold wet weather, and bad workmanship will be the consequence. Where stones are not to be had, wire fences may be substituted; these, if substantially executed, with good posts, make a very satisfactory enclosure. Hedges also make a good fence on suitable soil of pretty good quality, dry and not too light, if well attended to, and carefully guarded with paling until they attain their due height. They are, however, expensive to protect until they grow up, as they are several years before they form a fence of themselves: they have been abandoned in many places where they were once tried, as few farmers keep them well. Failing all these, turf walls, with a bar of paling on the top, may be resorted to, although not a very satisfactory fence, as cattle are apt to tear them down, and sheep go over them. If whins are sown on them, rabbits then lodge about them, and the ditches alongside of them are troublesome to keep.

The lines of enclosure having been determined, *Roads* should be constructed of sufficient width to let two carts pass easily, and allowing room to shift the tracks of the wheels. Having seen that the breadth is enough, good care should be taken to have them dry, both by side ditches and by underground drains, either below the road or alongside of it, as may be necessary, as without dryness no good road can be made or kept. The surface should be kept smooth, and sufficiently rounded to run the rain water off quickly. All ruts ought to be immediately filled, as, if they are once established, it is vain to expect the carts to keep out of them. A heap of broken metal should always be kept in readiness for putting on whenever it may be required. All loose stones should be raked off or broken small: where broken metal is to be used, the best stones are the tough varieties of trap, such as greenstone or compact felspar. Lines of road should run rather along

the lower ends of the fields, as the weight to be carted off ought always greatly to exceed that carted on; and the manure may generally be got out, for the most part, during frost, when the ground is hard and firm.

Having got access to the ground to be reclaimed, and determined the dividing lines, if the subject is wet, perhaps the first operation should be the *Draining*. It is an advantage to get that done before the surface is broken, as then the drains are not so apt to fall in; moreover, trenching ought to follow, and not precede, the drainage, because, the digging being best executed in the fall of the year, or during winter, it is desirable to prevent all stagnant water from souring the ground, and counteracting the beneficial influences of the frost and atmosphere, and the comminuting action of the spade. The stones that are turned up in the trenching will generally be more advantageously used for roads or fences than in drains, and the carting of materials on undrained trenched land is very toilsome and impracticable work. Therefore, presuming the ground to be clear of trees, whins, broom, and suchlike obstructions, let draining be the first thing where the land is wet; and whatever the nature of the soil may be, the first step towards that will be the securing of a good outlet. Whatever trouble or expense may be necessary, this should be effectually done, otherwise the drainage will be better left alone; it is the mouth of the whole thing; and if it is liable to be obstructed, every ramification through the field, especially if it is a level one, runs the risk of being choked. Outlets are, however, often heavy and expensive jobs. They are either open or covered water-courses; the latter are generally constructed of stones, and should be paved in the bottom, and the covering is of flags. Where the bottom is soft and full of springs, and the foundation consequently insecure for building upon, good stout boards should be laid across the bottom, and, if necessary, heather placed beneath them: this will afford a steady support for the side-walls of the drain. A ledge may also be made as a catch to keep the foundation-stones from being forced out by the pressure from behind. Instead of stone, these covered outlets may, in some cases, such as where they pass through very boggy level ground or quicksand, be constructed of a long wooden box, or series of boxes, made of good strong planks, securely fastened together by galvanised nails, and caulked at the joinings. If the bottom be very yielding, this may be made to rest on piles; and if carefully constructed, and accurately laid, a very slight fall will be sufficient —even as low as 1 in 1000 may be tried. If, however, laying aside the question of expense, it be wished to make a superior job, an egg-shaped duct, built of dressed stone or brick, and the joints closed with cement, is perhaps the best yet invented. They are extensively used in the London sewers.

Where flags are difficult to be got, or the water-course is of

large dimensions, it will be most economically made uncovered. If the fall is not great, and the soil of a nature that will stand, a plain ditch is the cheapest. The slope of the sides will vary according to the firmness of the soil; for small ditches, 1 foot horizontal to 1 foot perpendicular, will generally suffice. For deep cuttings no certain rule can be given: the thorough-drainage of the ground at the side of the cutting will conduce much to make the slopes stand; and without that, even good descriptions of ground will be apt to slip during tracts of wet weather. If the stuff is very yielding, the sides should be run off in a long low slope, by carting away the materials taken out; and if this is done to the extent of letting the ploughs work down to near the bottom, some compensation will be obtained from the breadth of land gained. This entails a good deal of work, but makes a very satisfactory job; and if earth is wanted in the neighbourhood, the labour may be turned to good account. Where there is a quick turn of the water-course, the sides at the place where the current strikes should have a mass of stones put in, faced up with large blocks regularly built, and, if necessary, clamped with iron.

Where there is a rapid declivity, the bottom may be paved with good-sized stones or brick, sloped from each side to a low angle in the bottom, or falls may be made at intervals, like the steps of a stair. Where good-sized flags are to be got, they make an excellent job of these falls, set vertically on their edge, with a good hold of the wall at each side, and well puddled behind with clay. Two or more flags should be laid flat at the bottom of the fall where the water strikes, as it will tear up small stones for some distance from where it rushes down. In the absence of flags, wooden planks may be used; they will stand a long time, if constantly covered with water. The top of the side-walls may be coped with a good sod. Mouths of drains coming into such water-courses should have a drop of several inches, so as to preserve a clear outlet in time of floods. The fall necessary for these water-courses will differ greatly according to the smoothness and hardness of the bottom. Ditches will do with as little as 1 in 300; but where the bottom is carefully paved with smooth materials, much less will do; it may be got to answer as low as 1 in 1000. Wherever there exists any doubt as to the sufficiency of run, the levels should be carefully taken, and a section made. Where the drain is a covered one below ground, a fall of 1 in 240 at least should, if possible, be obtained.

An outlet having been secured, then the rest of the drains may be set off, and in doing so we come to the question of depth and distance apart. As regards depth, recent experience has shown that it may be advantageously varied according to the nature of the subsoil. Where that is pure clay, of a very retentive nature, and when the evil results, not so much from bottom water as from

the retention of what falls upon the surface, then the drains ought to be close—say from 12 to 18 feet apart—and we would say of not less depth than 3 feet; although experience, in some cases in England, we admit, points to 30 inches. Where the subsoil is of a more mixed nature, the depth may be advantageously increased to 3½ feet; and where there is much bottom water, 4 feet will be found the most satisfactory. Except in the case of moss, or to catch the seat of a spring, we think it will seldom be found economical to go beyond 4 feet. In moss or peat, the drains should always be deep, and, if possible, be cut clean through to the firm strata beneath, as, after the removal of the moisture, this sort of ground will subside greatly if it was very wet before. Drains are generally made too far asunder. Even with an open description of bottom, they will seldom give a satisfactory result in very wet ground beyond 30 feet apart; but in the majority of cases 24 feet will be the limit. Where there is not much bottom-water, and the soil of a stiffish nature, 3-feet drains, 18 feet apart, we have found make generally very satisfactory work. We have seen it maintained, with a great deal of dogmatism and authority, that the roots of our cultivated plants having been traced 4 or 5 feet below the surface, and as they descend to that depth in search of food, the bottom water should be lowered to that level, and the drains in all cases made not less than 4½ feet. We consider, however, that this reasoning is founded on a wrong assumption; the fibrous roots found 4 or 5 feet deep are there, not in search of food, but in search of water. Doubtless it is proper to have a good depth of free soil for the roots to work amongst; but where the soil is so poor as that they have to dive 4½ feet for *food*, the cure, we apprehend, lies not in the application of drains to that depth, but in a supply of manure to enrich the soil. Some plants, such as carrots, and others of a like nature, require a good depth of *loose* soil for the development of their roots; but many others, such as vines and fruit trees, thrive best with their roots kept near the surface. As the action of drains is not a matter considered as yet set at rest, we may state some actual results of drainage, carried on under our own eye, and selected with a view to show their comparative workings at different dimensions.

A field of 39 imperial acres was close drained all over. The soil was a lightish loam, from 8 to 10 inches deep; the subsoil a hard reddish sandy clay or till, requiring the constant use of the pick, frequently containing large stones or boulders. It was, indeed, the boulder-clay deposit, or northern drift, derived from the hills of metamorphic rock in the vicinity of Dunkeld, which are mostly gneiss and chlorite slate, containing occasionally masses of trap. After going down many feet, it rested on the old red sandstone. The till, in some places, passed into a coarse sand or gravel, found not at any particular depth, but occurring mostly in the hollows.

After going to a depth of 4 feet, the till generally changed, for some distance down, into a dark purplish moist adhesive sandy clay, containing small fragments of the roots of trees, varying from the thickness of a quill to a few inches in diameter, soft and spongy, apparently the last traces of some ancient forest; and it was the decay of this vegetable matter that we thought was the cause of the darker colour, and the somewhat softer and more greasy nature of the till at this depth.

The ground, previous to drainage, was for the most part very wet, there being a great deal of bottom water; when in stubble, during wet weather, the foot sank in it up to the ankle, and no single-horse cart could go through it with more than half a load, and that with difficulty, unless downhill. It got wet at the close of the year, and did not get dry again until next spring: in a wet summer the green crops were drowned in it, but a good deal of it was in a waste state.

About 8 acres were drained 4½ feet deep, and 37 feet between the drains; about 15 acres were drained 3½ feet deep, and 24 feet between; and the remainder mostly 3 feet deep, and 18 feet between the drains—the soil and subsoil being the same in all the divisions, and the materials put in were 1-inch pipes with collars. The first crop after the draining was turnips, and the ensuing winter proved very wet. As regards the part drained 4½ feet deep, the result was, that, after a succession of heavy rains, the land continued soft and wet for a few days after the rain had ceased; and in walking across it the feet sunk too much, more especially when half-way between two drains, and the cart-wheels and horses' feet went down a good deal in most places. The rain water, in short, took too long to pass off. A few days of dry weather, however, made all firm. In places where a gravelly bottom occurred, yielding much water, the drainage was better, and nearly, but not quite, as well as could be wished. There was a good fall on the whole of the ground. Seeing the water in some places lying in little pools right over these deep drains, we thought some obstruction might exist in the pipes, and accordingly caused them to be opened in two or three such places. We, however, found all right below, and the pipes running but a moderate quantity of water. The drain appeared to be too deep for the surface-water to get down to it quick enough. Be it remarked, that the subject here was 9 inches of black turnip soil resting on hard till. A few drains put in 4 feet deep, and the same distance apart, gave a still more unsatisfactory result. The action of the 3½-feet drains was rather better than the 4½ ones generally, but the difference was not very great. Where the bottom was gravelly we cannot say that it was any better. The 3-feet drains, 18 feet apart, gave the best drainage, and the result was generally quite satisfactory; but in those places

where the rise of bottom-water was very strong, in such places their efficiency was not complete.

A small spot of this field, about a quarter of an acre, consisted of a peaty turf resting upon a blue spouty clay, very wet. Here it was found necessary to make the drains very close; the water would, in fact, stand almost immediately above the drains. We should consider drains 3 feet deep and 12 feet apart requisite for such ground.

The season after the turnips, the field was all under grain crop, sown with grasses; and after the crop had been taken off the ground, there came a tract of very wet weather. One day in October, when some heavy falls had ceased, which flooded the ditches and water-courses, we took the opportunity of walking over the field. We found the part drained 3 feet deep and 18 feet apart generally quite firm to walk upon, and no water to be seen on the surface. The ground drained 3½ feet deep, and 24 feet between, was not so dry in any part, nor uniformly firm to walk upon, being softest between the drains. Some water was to be seen in some of the furrows, but no pools. The part drained 4½ feet and 37 feet apart was in most places wetter than that at 3½ feet; where, however, we got the gravelly bottom yielding much water, there it was pretty firm and free of wetness. Furrow-draining 4½ feet deep seems very rare in Scotland. We have never seen any except what we executed ourselves, neither had any of the contractors we employed been engaged with furrow-drains beyond 4 feet. We may mention that the full deepness was rigidly gone to in the drains above alluded to, and a particularly good job made of them, the weather being very favourable.

Another field of 17 acres we drained with 1½-inch pipes, and collars 4 feet deep, and 24 feet between the drains, all over the field. The soil was moorish, and reclaimed, some few years before, out of the heather. It was situated near the field above mentioned, but both soil and subsoil were of a stiffer nature than in it, but less hard and stony, seldom requiring the pick. The top consisted of about 12 inches deep of a poor stiffish loam, being what had been turned over in the trenching; the under soil was changeable, for the most part stiff red clay, with almost no stones, very tenacious when wet, sticky and adhesive as putty. Not unfrequently it changed at a depth of 3 feet or so into a dark greenish or purplish sand,—not pure sand, but partaking more or less of an adhesive clayey nature, and derived from or related in some way to sandstone, as small fragments of old red sandstone occurred occasionally amongst it, and this rock protrudes in an adjoining field 200 or 300 yards distant, and we believe underlies all the tract of ground. Occasionally the clay would suddenly change from top to bottom into a bed of a sandy nature; this again, after a few yards, would perhaps revert into the clay,—

and so on. The sandy beds varied also in texture and hue, more or less coarse, but never changing into a right gravel. The bottom spit was often a dark purplish adhesive clay, resembling what was got in the field whose drainage we have already described, and, like it, containing occasionally bits of tree roots or twigs. The amount of bottom-water was not generally very great. The result was a perfect drainage of the whole field. In the autumn following, the stubble was firm, and in a state for deep ploughing, twelve hours after heavy torrents of rain had ceased. Several fields of the same nature as this one, and adjoining it, were previously drained with stones, 3 feet deep and 30 feet apart. The result generally was not quite sufficient; and where the rise of bottom-water was strong, decidedly imperfect.

Over about 500 acres, furrow-drained, and consisting mostly of newly-reclaimed soil, all lying contiguous to the above, and situated on the same formation, the results were similar to what we have detailed. Stone drains, we are of opinion, will act rather further on each side, and quicker, where there is a good fall, than pipe-tiles similarly placed. In stiffish soil, when carefully put in, they will stand a long time when there is a good slope on the ground.

There seem to be cases in flat ground where open strata are reached below, where a good deep drain, say 4 or 5 feet deep, will dry a great distance on each side. Although we have said that it will seldom be economical to go beyond 4 feet, yet, in order to reach the seat of springs, a few deep drains, judiciously placed, will often be a well-advised undertaking.

As to the execution of drains, we would strongly advise that the winter season should be avoided, as from the shortness of the day, and the risk of falls of snow, floods, and stormy weather, bad work is frequently the consequence. In cutting deep drains, where the sides are apt to fall in and the bottom get dirty, the earth should be first taken out along the whole line of the drain to within about a foot of the specified depth; the bottom spit should then be taken quickly out by two or more men, according to the length of the drain; and the bottoming and laying of the tiles in each drain should be begun and finished in one day; and no tiles, after they are laid, left during the night with less than one foot of earth upon them. This is the only way we have been able to make a satisfactory job with deep drains, where the sides are apt to slip in, or the bottom troublesome. Although it is always desirable to commence laying the tiles at the upper end of the drains, yet, in cases of running sand, and strata of a yielding watery nature, this cannot be well effected; they should be bottomed out very quickly, the tiles immediately laid in, and the earth returned above them, so as to prevent them being displaced by the rising of the bottom or falling in of the sides. In order to have this well done, the tile-layer must be a

very carefully-selected, conscientious, trusty man, one that will not put in a tile until he see the bottom in a proper state: he should also put in the first covering of earth upon the tiles himself, or see that his assistant does it carefully, and breaks or displaces none of the pipes. He should be upon day's wages, and well paid.

With regard to the materials to be put in where collars are not used, we think the pipes should be not less than 2 inches in the bore. Collars are generally made too wide and too short; they should be from 4 to 5 inches long. Where the bottom is clean working, and of a clayey nature, we think them unnecessary; in other cases we would prefer them; but they require very careful laying, otherwise there will be many bad joints. It is a good plan, where the drain passes over any very soft or bad spot, to sheath the pipes completely in others of a larger size, as Mr Parkes recommends, and which we have found answer well. For leaders we prefer large round pipes. Horse-shoe tiles we have not used latterly at all. The junctions of the small drains should be very carefully made, the holes into the leading tiles fitted very exactly, and clay firmly rammed all round about. The connecting of leading drains together is often very carelessly done. Tiles neatly made for the purpose should be got from the works. The tile-layer should have a tool for dressing tiles, and a sharp chisel and mallet for taking out holes.

In flat ground, small pipes are very apt to get sanded up, and a larger size than usual should be put in. Want of sufficient fall is the ruin of more drains than any other cause whatever.

We sometimes think that a better material than what we have at present might be got for drains,—tubes of a description that would admit water through their sides, and exclude sand and all solid matter, and to be laid in long lengths, and closely secured at the joints. Our present pipes make a pretty good job in a clean working bottom where there is a good fall; but with fifteen hundred or two thousand joints, and consequent chances of going wrong in every acre, frequent imperfections can scarcely be avoided.

In draining deep peat-mosses, large open ditches must first be made, and the drains not completed at once; but after being cut down 2 or 3 feet, some time should be allowed for the moss to subside. Where the peat cannot be cut through, wooden boards should be laid for the tiles to be placed upon, or hollow wedge-drains be constructed; these latter, if rightly done, will stand well, and are cheap. In flat ground, drains will sometimes draw a good distance in peat, and deep open ditches will occasionally lay dry a considerable breadth of moss.

Having got the land drained, the next thing is to clear the surface of stones or rubbish; and if the subject is rugged, stony, or encumbered with tree roots, whin, broom, or other obstructions, the most satisfactory proceeding will be to have it all thoroughly

trenched with the pick and spade, burying the rough sod in the bottom of the trench, and leaving all stones, roots, and rubbish on the surface to be carted off. The shoulder-pick, in the hands of a brawny rustic, will take no denial from the most stubborn moor; its persuasive tap is the most cogent argument hitherto discovered for inducing such soils to yield up their treasures; it is the "open sesame" to all the riches within. The larger stones are left exposed, to be dealt with by gunpowder and steel. In blasting large blocks of several tons' weight, a larger jumper than ordinary should be employed. The greenstone and other trap boulders are generally easy to bore, being of a soft nature, and break up well: those of gneiss vary much; if full of veins and seams, they are often troublesome to blast by reason of its flying off in small pieces. Quartz-rock boulders are the hardest to bore, but generally break up well; so does granite. The largest blocks we have always found to be of gneiss.

The amount of stones turned out on some recently-reclaimed tracts in Scotland is an admirable proof of the spirit of agricultural improvement which is now abroad: we have seen fields in Kincardineshire, after trenching, whose surface presented a complete skin of blocks—a perfect Arabia Petræa on a small scale; and, if we mistake not, there is to be found, in the classic neighbourhood of Drumthwacket, a spot which has been christened Gibraltar, from the formidable ramparts of stone fences erected out of the produce of the trenching. We have also seen in the same county a tract of recently-improved ground, where the amount for blasting of stones over forty-four acres averaged £6. Verily, in demanding bread of the soil the husbandmen has received here a stone as the first-fruits. In some places what are called consumption-dikes have been made by building two face dikes containing between a broad space filled up with stones. The stony nature of improvable land, within certain limits, is not, however, without advantage, from the admirable fences for which it supplies materials close at hand. Trenching is best proceeded with in winter, as the ground is then softer, and it is almost always done by contract. It may be of any depth not less than 14 or 15 inches.

The cost of trenching, draining, and clearing off stones need not be detailed, as hardly two cases are alike, and such estimates are of no practical utility. Trenching generally costs from £6 to £8 per acre; sometimes, however, it will reach to £11 or £12. Blasting and clearing off stones varies exceedingly from nothing up to £6 or £8. Draining with tiles also varies according to the hardness of the bottom, the depth and distance of the drains, and the price of tiles in the locality. The average may be from £5 to £6 per acre in Scotland of late years, excluding carriages.

Where the ground is naturally less rugged, or has been partially cleared beforehand, trenching may be dispensed with; and the most

satisfactory and economical way of proceeding with its improvement we have tried is, to break it up with the common plough first, making a Read's subsoil-pulveriser follow in the furrow close behind. This breaks up and stirs thoroughly the bottom of the furrow, and will leave a loosened mass of soil to the depth of 15 inches. A boy or woman, carrying a bundle of wooden pins, attends the man who guides the pulveriser, and whenever he comes upon a stone, a pin is stuck in to mark the spot, and a sufficient number of men with picks and spades follow to take out the stones as fast as the ploughs move. Where any large block occurs, that would delay them too long to take out at once, it is left exposed, so as not to stop the ploughs, and such are taken out afterwards by blasting or by large levers. The number of men required will vary with the nature of the ground. We have seldom found more than four necessary after each subsoiler; for if more than these be required, the ground will probably be so rough as to render trenching more expedient. The sock of the pulveriser should be made pretty broad, and may be altered in shape to suit different circumstances of the soil. Two or three should be always kept for each implement, made of the very best malleable iron that can be got, as otherwise they will break readily at the neck. Land treated in this manner under good superintendence will be found thoroughly loosened, and admit of a spade being thrust down past the blade in any place. It may even be superior to trenching in some cases, as it does not bury the top sod, which contains the best of the soil. Tried extensively, we have found its results satisfactory, and the reclamation complete.

The following is a statement of the actual cost per imperial acre of the reclaiming of the last field we treated in this manner; horse-work being charged at the rate of ten shillings a-pair *per diem*, men one shilling and eightpence a-day :—

First ploughing, ...	£0	16	0
Subsoil pulverising, ...	0	16	0
Marking and turning out of stones after the pulveriser,	0	14	0
Blasting and turning out larger stones, . .	1	17	0
Clearing off stones and levelling up holes, . .	1	0	0
	£5	3	0

The ground here was thoroughly broken up and loosened to a depth of 14 or 15 inches, and completely cleared of stones to that depth.

The stones left on the surface by the preceding operations are now to be taken off, and may be disposed of for fences, roads, drains, water-courses, filling hollows, making wells or buildings. They are removed either by carts or sledges. The irregularities of the surface are then to be levelled where they would impede the operation of the plough, and the ground prepared for crop.

In dealing with deep pure moss or peat, it will be necessary, for the proper improvement of it, to add some more solid matter to give it greater consistency; and we would unhesitatingly approve of burning the surface at the first taking in of such ground, as there is no fear of wasting the vegetable matter of a soil like this. It will destroy the tough sods which tumble about unbroken beneath the harrows, and the ashes resulting therefrom have a powerful effect upon the first crop. We have seen decent turnips raised in such cases in Ireland, without any other manure than the ashes of the surface.

As to the stuff best adapted for mixing with peat, sandy earth or even sand itself is a very satisfactory application, put on thickly, at the rate of 100 tons and upwards to the acre. Marl, where it is to be had convenient, may likewise be used, at the rate of 100 cubic yards or so to the acre; but the continuance of it does not always answer, and in some cases it has been found necessary to discontinue it. Potatoes have been found, at least in some places, to thrive best on unmarled moss. Where good clay occurs below the surface, it may be thrown up from parallel trenches dug about 10 yards apart; but all kinds of clay are not suitable. The presence of lime appears to be necessary for the proper improvement of peat. Sometimes it occurs in the peat itself; if not, it should be included in the application, and a mixture of salt with it has been found advantageous. The lime itself should not be too heavily applied, as it will make the ground too loose and puffy. About 4 tons per acre will be enough for the first application. Instead of much lime, we would advise a heavy application of bones, as they will supply not only lime but the phosphates, in which peat is deficient. For green crops in peat they will, we think, never be found otherwise than beneficial. As a manure, when to be got, nightsoil and ashes perhaps can hardly be excelled for such ground. Farmyard manure should be well made, so as not to keep open such a loose soil—the principle to be kept in view, with regard to peat, being to do what will impart solidity to it, and supply those earthy and mineral ingredients in which such a soil is always deficient.

As to the cropping of reclaimed peat, potatoes will be found the most paying thing to put in, as they generally keep sound in it. After that, turnips or other green crop; and afterwards, for a grain crop, oats; but corn crops should be avoided for a year or two. Guano, mixed with either bones or rape-dust, we have found to raise excellent crops of potatoes or turnips in peat without any other manure. In the Western Islands, fair crops of potatoes are raised on peat with no other manure than sea-weed, but the quality is watery. The ploughing may be shallow in peat, and the rolling cannot be too heavy.

Irrigation has been found to answer upon peat. Where planting

is to be attempted, Scots pine and spruce will be the most likely to succeed; and where the peat contains a mixture of clay or sand, they may thrive pretty well. Willow and birch have also been recommended.

As to the first treatment of other sorts of reclaimed land, it is generally considered advisable to give such ground, brought in for the first time, an application of lime; and the practice appears to be a correct one. A considerable tract of land, which we had for some time under our charge, had been trenched by the proprietor out of an extensive moor, and after a crop or two had been taken, upwards of two hundred acres of this raw material had been laid down to grass without lime, the owner of it being under the impression that lime was of little benefit. A few ridges, however, of some of the fields had been limed by way of experiment; the consequence was, that after ten years had elapsed, these pieces continued to show themselves much greener, and were always more closely cropped by the stock; and all this piece of ground is now being relifted and laid down again to grass, with a heavy liming. Its natural state previous to the trenching was a heathy moor, mixed with coarse grass, and growing thick clumps of furze upon the best dry places, and in the swampy spots covered with rushy pasture. It was of a stiffish nature, resting on a stiff, mostly retentive, subsoil.

For land, however, which has been partly under cultivation before, and been let go again to waste—as is the case with a great proportion of our uncultivated soils—the benefits of liming are not always so marked: it certainly has frequently little effect, the first season or two. In a field of this description, which we limed in March 1852 at the rate of 4 tons per imperial acre, we left a portion unlimed, and alongside of it a portion limed at the rate of 8 tons per acre. It had been the previous season in potatoes, dunged; and in the succeeding season, crop 1852, it was in oats sown out with grass. No difference was observed in the braird, and the three pieces came up alike until the month of July, when the double-limed bit began to take the lead; that dressed at the rate of 4 tons stood next, and the unlimed portion was rather worst, but the difference was not remarkable. When they came to be cut, the distinction was more obvious, and they ranked as before,—the part unlimed being thinner and shorter in the straw, the part limed at the rate of 8 tons per acre the thickest and most luxuriant, and that limed at the rate of 4 tons intermediate. The contrast, however, was not very striking. During winter and spring no difference was to be noticed in the young grass until the month of May, when the portions began each to rank as before, and the difference extended gradually until the grass was cut in the end of June. Then the unlimed piece was evidently behind the other two, and the bit limed at the rate of 8 tons was perceptibly supe-

rior to that dressed at the rate of 4 tons. It was in the rye-grass that the diversity was chiefly apparent, it being closest in the bottom, and thickest and tallest, where most lime was laid on. The quantity of white clover and weeds was much alike in both, and the red clover failed in all the three pieces. The soil was a lightish loam, about 9 inches deep, resting on a retentive subsoil, thoroughly drained. A great deal has sometimes been said about burning with lime,—the above would tend to show that, for the first few years at least, even with a light indifferent soil, the benefit was in proportion to the quantity laid on. We may mention that we also limed about 15 acres of a similar description, at the rate of from 7½ to 8 tons of lime per imperial acre, and saw no traces of burning; it was done after a crop of swedes. Where, however, the swedes had got nothing but guano and bones, the braird, after it had come up, took on a blanched, whitish appearance for a short time,—which, however, gradually went off. We are of opinion that, where a good quantity of dung is applied, there is little danger of over-liming, except in the case of peat, which is apt to get loose and puffy. We would not, however, like to risk a heavy liming with only a slight application of farmyard dung. We may mention, for the sake of those who are accustomed to buy lime by the boll, that 1 ton of lime-shells was considered, where we were, equal to 6 bolls; consequently, 8 tons equal 48 bolls.

In putting on lime, it should always be kept as near the surface as possible, as its tendency is to sink. It answers perfectly well to be put on in spring, before dunging the turnip land, and no fear need be entertained of its spoiling the effect of the manure. It may even be put on the drills after the plants are brairded. The chief thing is to keep it near the surface, and get it as well mixed with the soil as possible.

The first crop on reclaimed heath land, where it has been ploughed, should be oats; where trenched, either oats or turnips. We have found the latter do well even where the ground was so rough as that the drills could hardly be seen. In either case we would advise a good application of guano—from 3 to 4 cwt. per imperial acre. Barley does not do well on new trenched ground, and should not be attempted. Awny spring wheat we have found thrive well as the second crop, turnips having been the first. Grass sown without cereals, as the first crop after trenching, we have found always come up very vigorously, and of a dark green colour.

We do not think newly-reclaimed moorland should be laid down to permanent pasture, or even to two or three years' grass. Such ground seldom pastures well; and graziers dislike it, as it will not feed beasts: it is also bad for milk. To lime it and manure it heavily, so as to have rank strong-growing crops upon it, seems the treatment most suitable, as the great roots which they throw out disintegrate the raw soil, and make it more pervious to atmos-

pheric action. Frequent and deep cultivation, to expose it to the influence of the frost and air, seems necessary for such soils. Deep ploughing has been maintained not to answer for some soils in England; we can only say that we have never heard of it not answering in Scotland where the ground was dry or drained. The dark green lines of close-eaten grass over our drains mark for a long time, in characters that even those that run may read, the effect of a thorough loosening-up of the soil. The idea that land will feed itself in grass, is true only of good soil; but poor newly-reclaimed ground will do quite otherwise than feed itself. The finer grasses soon vanish from its surface, and are replaced by fog, daisies, ranunculus or crowfoot, *Prunella vulgaris*, and by *Holcus lanatus*, and suchlike coarse grasses and weeds; and eventually the heather and furze appear, showing the tendency to revert to its natural state. Rather, therefore, keep such soil in high condition, and leave it only one year in grass for a time, until it begins to turn into something like land. We suggest a cropping something like what follows:—

1st	year,	Oats, with 3 to 4 cwt. of guano.
2d	„	Turnips, well dunged and limed.
3d	„	Oats.
4th	„	Potatoes, manured.
5th	„	Awny spring wheat, top-dressed.
6th	„	Grass.
7th	„	Oats, with guano.
8th	„	Turnips, dunged and eaten partly by sheep.
9th	„	Barley, sown out with grass seeds.

Fine expensive oats need not be sown on reclaimed heath ground, as they get coarse in one season.

Where, however, circumstances render it expedient to lay such land down to grass, we would recommend that this be done without a grain crop. We have tried the plan over upwards of 50 acres of such ground, and can speak favourably of the result. The grass seeds should be sown thickly—about 3 bushels to the acre, if the land is poor. Some advise a mixture of barley, but a good proportion of Italian rye-grass is preferable, as the barley sometimes does not come up well. If the preceding crop was turnips, the land need not be ploughed, but wrought with two turns of Tennant's grubber; sometimes one turn of it will suffice, if the ground is not hard. The surface should be made very fine by harrowing and rolling, and a heavy rolling should succeed the putting in of the grasses, to be repeated after they braird. The grass will come up unequally, and faster in some places than in others. Annual weeds, such as spurry (*Spergula arvensis*) and *Persicaria maculata*, also occasionally come up strongly. A good plan is to mow it all over as soon as it will stand the scythe, and then put on sheep. They will eat it very close, as it is sweet; and next season no annuals will be seen, and the land will be found very clean.

Tracts of a very sandy nature have sometimes to be taken in. The best mode of dealing with them seems to be, where a heavy marl is to be had, or clay containing a mixture of lime, to lay that on thickly, at the rate of 50 tons or upwards per acre, and try potatoes. Clay or marl is occasionally to be got below such soils, and may then be thrown on the surface out of parallel trenches. The land so treated will not reach its productive state for a year or so, until the clay gets pulverised and thoroughly mixed with the sand.

Shallow lakes may be occasionally drained and brought into cultivation. The muddy bottom will take some years to solidify, and if large, the improvement must be of a gradual progressive nature. The first thing to be done is to have a main outlet or leading ditch constructed; into this run parallel ditches, and leave all open for some seasons, until the ground settles down and solidifies to some degree. During this time a deal of pasture or rough foggage may be got, and heavy cuttings of aquatic plants. Ditches should be made all round it, to cut off the water from the higher grounds. If the bottom continues of a shaky muddy nature, it may be most advisable to keep the surface dry by these open parallel ditches, and retain it as a meadow. A great mass of stuff will be got off it, and it will be best pastured by cattle of a not too heavy description, such as West Highlanders: sheep are apt to rot on it.

We had for some time in our hands a lake treated in the above manner, extending over about 200 acres. Its bottom was a rich bluish mud for many feet down in most places. It being near the level of the sea, and the bottom of such a soft nature, covered drains were not attempted. It was kept dry by parallel ditches, and we pastured it with West Highland cattle and ponies, and a considerable extent was generally cut for meadow hay.

We now proceed to give some actual results, deduced from a considerable breadth of reclaimed ground, and selected with a view to show what increased value and progress in productive power have arisen, after the lapse of different periods of time, since the date of reclamation, and consequent upon different modes of treatment.

About the year 1840, and a few subsequent years, some 250 acres of waste ground, lying to the south-east of Birnam Hill, in the parish of Little Dunkeld, Perthshire, were trenched and brought into cultivation by the proprietor. Its original condition was part of a heathy moor, sloping with gentle undulations in an eastern direction, and lying right in the line of march which the famous wood must have taken on its way to Dunsinane, an expedition from which the trees of that classic locality seem never to have altogether recovered. Its surface was generally occupied by whins in the drier portions, where there was any depth of soil, and in the thinner knolls by short open stunted heather, mixed occasionally with coarse benty grass. In the wet hollows the water had frequently

lodged some accumulation of sandy mud; and such pieces, when drained, formed the best ground. The moist portions, where the water did not lie, were covered with coarse rushy grass. The whole subject was rather a stiffish quality of soil, and rested on a retentive red till, beneath which lay the old red sandstone; and the worth of it in this state was estimated by a very competent valuator to be not above 2s. 6d. yearly per acre. These 250 acres were, after a crop or two, laid down to pasture, and let as grass parks by public roup, so that from the rents thus obtained a perfectly unbiassed statement of the improved value can be given. Being naturally wet, almost the whole was drained, and this was done with the stones got from the trenching and blasting, 3 feet deep and 30 feet apart. Most of the fields got no lime, and many of them received no other manure than bones and rape-dust. The stones being mostly consumed in the drains, fences were erected of wooden paling. The trenching and draining averaged £13 per acre. Here are some of the results after the lapse of several years.

No. 1.—A field of 27 acres. Had been trenched, drained, and moderately dunged, but not limed. The drainage was pretty good, and naturally it was a lot of rather better than average quality. In 1852 it had been about twelve years in grass, and was a good deal fogged; in the thin knolls traces of heather were appearing, and there was little keep for stock upon it till usually about the 1st of June. During 1852 and 1853 its rent, per imperial acre, averaged 19s. 2d. We ploughed it up out of the lea to put it through a course of cropping, and sowed it in spring 1854 with oats, giving it in all 33 cwt. of guano, applied on the worst places. The whole of the crop was sold by public roup, at an average of £8, 16s. per imperial acre.

No. 2.—A field of 16½ acres. Had been laid out to grass about the same time as the above, but some of it had got no dung; otherwise its treatment was the same. On one side of it the drainage was rather imperfect, but naturally it was one of the best lots of the ground: it was a good deal fogged in most places, but much of it had still a good green colour, and was pretty closely eaten by the stock. During the three last years its rent has averaged 23s. 9d. per acre.

No. 3.—A field of 17½ acres. Had been in 1852 upwards of ten years in grass, and had been laid out without either dung or lime, and was naturally a bad lot. Heather and whins were beginning to appear in many places, and in parts the drainage was imperfect. In 1852 it let for 15s. 4d. per acre. We ploughed it up, and sowed it with oats in spring 1853, giving it 3 cwt. per acre of guano over the whole field. The crop averaged fifty bushels per imperial acre.

No. 4.—A field 17½ acres. Also a bad lot, and laid down to grass without either dung or lime. The drainage was tolerably

good. Heather and whin were beginning to show themselves, and during 1852 and 1853 its rent averaged only 13s. 4d. per imperial acre. It was ploughed up and sown with oats in spring 1854, getting 3 cwt. per acre of guano over the whole field. The crop was all sold by public roup, and averaged £8, 9s. per imperial acre.

Some fields, whose condition had become similar to that of Nos. 3 and 4, were broken up a few years before, and put through the following course of crops:—1st, Oats; 2d, Green crop (for which the stubble had been deeply ploughed with three or four horses, to bring up the original sod, buried by the trenching), well limed and dunged; the crop all carted off, and the land sown with, 3d, Wheat and grass seeds, also getting generally some dung. We select the following: No. 5.—A field of 16½ acres. In 1852 it was under first year's grass, pastured with sheep. In 1854 it was let as three-year-old grass, at an average rent of 26s. per acre. No. 6.—A field of 14⅛ acres. In 1852 it was under first year's grass, cut for hay, and was let, in 1854, at an average rent of 28s. per acre. No. 7.—A field of 20 acres, more heavily dunged than the preceding two. In 1853 it was under first year's grass, cut for hay, and in 1854 was let at an average rent of 40s. 6d. per acre. Part of this field was so poor that it hardly covered itself with heather in the original state. This side of it, instead of being put under wheat when sown out to grass, was in oats; and some of the stalks on this worst portion measured 6 feet 5 inches in height from the surface of the ground, and the average per acre of the whole was 57 bushels, it being rather much lodged in some places, and exposed to damage by game. *N.B.*—Nos. 5, 6, and 7 were all liable to much injury by rabbits and hares.

Some fields of this same tract of ground were reclaimed at a later date, and drained with tiles. Of these we give

No. 8.—A field of 21 acres. Partly trenched, and partly ploughed and subsoiled with Read's pulveriser. All drained and limed. One half moderately dunged, and the turnips carted off; the other half manured with bones and guano, and the turnips eaten off by sheep. In 1851 it was in first year's grass cut for hay. In the three following years it was let for grazing at an average rent of 21s. 8d. per acre. Naturally it was below an average lot.

Upwards of 200 acres were reclaimed of a lighter and inferior description of waste ground, lying mostly to the north side of the above, and containing patches here and there of land which had been recently cultivated, but had gone again to waste. All wet and lying on a retentive till, and drained with pipes at different depths and distances apart. It was mostly brought in by the plough followed by a Read's subsoil-pulveriser in the manner detailed in a former part of this report, the worst and most rugged places only being trenched. Upwards of 50 acres were laid down

to grass without a grain crop, receiving no dung, but having the green crop (which consisted partly of potatoes and partly of turnips) raised with guano, combined either with bones or rape-dust. The turnips were consumed on the ground by sheep, and the land got no other application, previous to the sowing of the grass seeds, except 4 tons of lime per acre. It was partly mown and partly pastured the first autumn, and next season 36 acres, being a fair cut of it, were let to a grazier at 32s. per imperial acre; and since leaving the quarter, we have had a communication from the agent who manages the property, to the effect that it is about to be let to the same party on a lease of years, to be kept in grass, at 28s. per acre.

A field of 25 acres reclaimed at the same time, of quality upon the whole superior to the above 50 acres, and similarly treated, except that it had a greater weight of turnips eaten upon it by sheep, the crop being better, got the same quantity of lime, and was sown out to grass with a crop of oats, which, although damaged in some places a good deal by rabbits, averaged over the whole field 40½ bushels per imperial acre. It was grazed the next year by our own cattle, and did very indifferently, being very inferior to the land sown out without a crop. It was let in 1854 as two-year-old grass for 17s. 7d. per acre. And this inferiority in the rent we consider was owing solely to the different mode of laying down to grass. It was better watered, and as favourably circumstanced in regard to fences as were the 50 acres before mentioned, which latter were also even more exposed to damage by rabbits and game, being, in fact, surrounded on all sides by covers strictly preserved.

We give the following instance of a piece of ground reclaimed in a speedier manner than is generally done, to show that there may be frequently time unnecessarily lost in what is called giving the surface time to rot. We trenched it out of the rough heathery state in March 1852 at a cost of £5, 6s. 8d. per acre; and the expense of the drainage, which was executed subsequently to the trenching a few weeks, amounted to within a trifle of £5 per acre, exclusive of carriages. The stone-blasting cost about £2, 10s. per acre. And the same season, June 1852, we sowed the ground with white globe turnips raised with 7 cwt. per acre of a mixture of guano and dissolved bones. The surface was so rough that the drills, after being formed, were in some places hardly distinguishable; however, the turnips grew well, and reached a weight of about 18 tons per acre. They were all carted off, and the ground sown next season with awny spring wheat, getting an application of about 10 tons of rather rank farmyard dung. The following is a statement of what the produce realised per imperial acre:—

Grain, weight 61 lb. 28½ bushels, at 8s. 4d., . .	£11 17 6
Light grain, 2¼ bushels at 6s., ...	0 13 6
	£12 11 0

Grass seeds were sown with the wheat, and the appearance, when we saw it last in April 1854, was very promising.

In conclusion, we would express the hope that agricultural improvement is only yet gathering its strength, for there is still much to do. It would appear that, in Italy, land of average quality, possessing no special advantages, is by irrigation made to yield 24 tons of grass per acre in the course of a year. We do not see why British ground should not be made to do the same, allowing something for difference of temperature. With the help of sewerage matter, this may apparently be exceeded in Scotland, as is instanced by the results obtained by Mr Telfer of Cunning Park. Let us treasure up the contents of every sewer and stagnant puddle that is now spreading pestilence through the land: instead of filling our churchyards, make them, in the first place, fill our barnyards. With the refuse of every factory economised, and the sewerage of every drain and gutter turned over our fields, who can place a limit to the productive powers of our soil? Reclamation of new ground cannot go on without foreign supplies of manure, as the older land will take all that proceeds from itself, and much more, if it can get it. Therefore, failing Peru, we must look around us. If, instead of laboriously dragging manurial supplies from the other side of the world, we can find it nigh us, even at our doors, proclaiming, by cholera, typhus, and nuisance-removal acts, that at least it ought not to lie *there*, then Peru may go; we need it not.

On one occasion in the Peninsula, afflicted officers of the commissariat complained sadly to Wellington that the supplies were running short—that, in fact, the last of the Spaniards' cattle were about eaten up. "Well, then," said the great Duke, "we must just fall upon the sheep; and when they are all finished, I suppose we will have to go." In like manner a cry is beginning to arise that the guano is nearly at an end; and what, asks British agriculture, is to be done? O British agriculture, if the guano is finished, you will have to fall upon the nitrate of soda, and the phosphatic coprolites of the crag; and when the last nodule is gulfed up, why then you must go to the sewerage of our town population, for there or nowhere is your Peru.

REPORT ON PLOUGHING LEA.

By Mr JAMES PORTER, Land-Steward, Monymusk, Aberdeenshire.

[Premium—The Gold Medal.]

THE plough is perhaps the best and most efficient of our agricultural implements; and if not the most ancient, it must be very nearly so. Virgil, Horace, and Pliny were all farmers, and they talk of its being used by the Romans at a very early date. It seems to have then been but very rudely constructed, consisting of a beam and only one handle, made of two crooked pieces of wood. Some kind of a share appears to have been attached, but no mouldboard of any description. This rustic piece of mechanism had more the resemblance of our subsoil-plough than any other kind of plough now in use, and its description indicates how imperfect it must have been. It is not proposed here to trace the progress of the plough, nor to recapitulate the improvements which, from time to time, have been made on it. As agriculture advanced, better ploughing and a finer description of implement were naturally sought for, and men of inventive genius began to turn their attention to the subject. Mr James Small, an East Lothian mechanic, was perhaps the first who produced a really efficient plough: it has been long well known by his name. Many of our best mechanics have imitated, and no doubt improved on it; and till of late years, when ploughing-matches became so numerous, and the rage for *high cutting* began to increase, it was generally adopted throughout the country, with the marked approbation of the most eminent agriculturists. With so many ploughing competitions, the taste for fine-looking work has now become the order of the day, and the *high-crested* plough the only favourite. Many of these implements, *said* to be improved, have from time to time been presented to the public, but the one most in vogue, I believe, was invented by Mr Wilkie, of Uddingstone, near Glasgow, and is known by the name of Wilkie's *high-crested* plough. It cuts the furrow-slice at a very acute angle, and produces a fine crest of mould on the top, always standing considerably above the square. Nearly all our mechanics now imitate this implement with less or more alterations, always taking care to preserve the *high crest;* otherwise their characters as plough-makers would soon be at a low ebb among prize ploughmen.

The propriety of *high-crested* ploughing has at length begun to be questioned by many practical farmers. Of the utility of the system I was always rather doubtful, and with the view of throwing some light on the subject, I this year, on the home farm of Monymusk, in Aberdeenshire, determined to test the matter by actual experiment, in a comparative trial; between the two-pair

horse ploughs already alluded to, and a trench-plough drawn by four horses. The high-crested plough was of iron, made by Sellar and Son, Huntly; it weighed 2 cwt., and cost £4, 4s. The other two ploughs were of wood, made by a plough-wright in the district, and were both imitations of Small's plough; the pair-horse one weighed 1⅝ cwt., and cost £3, 12s.; and the trench weighed 3¼ cwt., and cost £5. The experiment was conducted on heavy as well as on light soils; and in order to make the contrast as widely different as possible, it was deemed best to choose the heaviest and the lightest soils on the farm for the purpose. The depth and breadth of the furrow-slices of each lot were measured by a member of the Highland Society when newly ploughed up.

1. *Heavy Soil.*—The field on which the first experiment was conducted is good haugh land, composed of rich alluvial soil, from 15 to 20 inches deep, on a dry open subsoil of sand and gravel, and is worth about 35s. per acre. From its proximity to the mansion-house, it had lain in grass and been pastured by cattle for the last seventeen years; and as the working merits of different ploughs *tell* best in firm compact land, this field may be considered well adapted for the purpose. It is easterly exposed, 18 miles inland, elevated 300 feet above the sea level, and contains 22 acres. The experiments were done in duplicate, and the plots, consisting of ½ acre each, were laid off thus:—

1st. Trench-plough.	2d. Wilkie's high-crested plough.	3d. Small's rectangular plough.	1st. Trench-plough.	2d. Wilkie's high-crested plough.	3d. Small's rectangular plough.

Although the whole land was particularly equal, I always prefer trying experiments in the centres of fields; they are best exposed to sun and air, and safer from the inroads of cattle, should they happen to break the fence. Accordingly, on the 14th of January, I had the different plots measured off in the centre of the field, and ploughed on that and the two following days. On the 13th of March they were sown with Sandwich oats, at the rate of 5½ bushels per acre. The crop was reaped on the 9th September, and stacked in fine dry order on the 18th September. It was thrashed, weighed, and measured on the 25th and 26th October, and the following Table exhibits the results:—

TABLE I.

TABLE I.

No. of plough.	Description of Plough.	Dimensions of furrow-slices.		Weight of straw, &c., per ½ acre.	Light oats, per ½ acre.	Market-able oats, per ½ acre.	Weight per bushel.	Weight of straw, per acre.	Market-able oats, per acre.
		Inches depth.	Inches breadth	cwt. qr. lb.	bus. pks.	qr. bus. pks.	lb.	cwt. qr. lb.	qr. bus. pks.
1.	Trench-plough,	10	14	18 0 0	1 2	3 3 1½	40¼	0 0 0	0 0 0
1.	Do. do.,	10	14	18 2 0	1 3	3 3 ½	40¾	36 2 0	6 6 2
2.	Wilkie's high-crested plough,	6	9½	17 1 21	1 1½	3 3 1	41½	0 0 0	0 0 0
2.	Do. do.,	6	9½	17 2 14	1 1½	3 3 1	41½	35 0 7	6 6 2
3.	Small's rectangular plough,	6	9½	19 1 0	0 3	3 4 3	41½	0 0 0	0 0 0
3.	Do. do.,	6	9½	19 0 9	1 0	3 4 2	41¾	38 1 9	7 1 1

2. *Light Soil.*—The field for the second experiment contains 14 acres, worth about 12s. 6d. per acre, and consisting of a very inferior description of outfield land. To the depth of 7 or 8 inches the soil is poor, black, and moorish, resting on a subsoil of irony deposits and coarse gravelly clay; and although it was lately drained and subsoiled to the depth of 20 inches, it has always failed to produce remunerative grain crops. It has been wrought on a six-course shift—1st, oats; 2d, turnips; 3d, 4th, and 5th, grass pasture; 6th, oats—and was ploughed from three-year-old lea in January 1854. On the 20th of January I had 3 acres chained off, where the land was pretty equal, in the centre of the field, and ploughed by the different ploughs within three days thereafter. It was sown on the 23d March with Sandwich oats, at the rate of 6 bushels an acre. The oats were cut on the 5th of September, and stacked on the 15th of the same month; thrashed, weighed, and measured on the 27th October, and the results obtained were as stated below:—

TABLE II.

No. of plough.	Description of Plough.	Dimensions of furrow-slices.		Weight of straw, &c., per acre.	Market-able oats, per acre.	Weight per bushel.	Light oats, per acre.	Total of oats, per acre.
		Inches depth.	Inches breadth.	cwt. qr. lb.	qr. bus. pks.	lb.	bus. pks.	qr. bus. pks.
1.	Trench-plough, . .	9	13	24 3 3	2 5 2½	39¼	1 2½	2 7 1
2.	Wilkie's high-crested plough, . . .	6	9½	26 2 26	3 0 0	40	1 0½	3 1 0½
3.	Small's rectangular plough, . . .	6	9½	27 1 0	2 7 3½	39¾	1 1½	3 1 1

In order to save labour, the whole of the oats and straw were weighed on the steelyard when put into the barn; and when threshed, the weight of the grain was deducted from the gross weight, which, of course, left the nett weight of the straw and chaff.

Remarks on Table I.—It appears from this table that Wilkie's plough and the trench-plough have produced the same quantities of grain, but the latter gave about 1½ cwt. of more straw. The grain after the trench-plough was 1 lb. per bushel lighter, and the quantity of small oats was also a little more. The crop after the trench-plough did not ripen so evenly as after the other two, which accounts for the lightness of the grain, and also for the greater quantity of small oats. Small's plough produced nearly 3 bushels more grain than either of the other two; 1 cwt. 3 qrs. 9 lb. more straw than the trench-plough; and 3 cwt. 1 qr. 2 lb. more than Wilkie's plough. The oats were about the same weight as by Wilkie's plough, and fully 1 lb. per bushel heavier than the trench-plough; the quantity of small oats was somewhat less than from either of the other two. It will thus be seen that, in this case, Small's plough gave the most satisfactory results, and, reckoning its extra produce at the then market price, oats 28s. per qr. and straw 2s. 6d. per cwt., there is a balance in its favour of 17s. 9½d. per acre over Wilkie's plough, and 19s. 2d. per acre over the trench-plough, adding 5s. an acre for the extra cost of working the trench-plough with four horses. The small oats were very worthless, and in either case I have put no value on them.

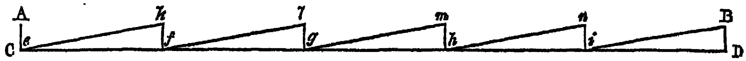
Remarks on Table II.—This Table does not show results so different as the last; the produce of both the pair-horse ploughs being very nearly the same. The trench-plough, however, was again a little deficient, particularly in the quantity of straw. I presume that in this case it was wrought under a disadvantage, by its turning parts of the coarse subsoil to the surface. From the soft tender nature of this description of land, the cut of the plough is not matter of much consequence, as any plough that will work a steady fair deepness, and put the furrows close together, will answer; for the harrows on such land soon produce plenty of mould. The soil of Table I. was better suited for testing the merits of different ploughs, and in the results arrived at there I have much confidence.

Remarks on the Ploughs.

Trench-Plough.—In both the above trials this plough produced results of an unsatisfactory nature. By ploughing to the depth of 9 or 10 inches, it must necessarily cut the furrow-slices too broad; for in all cases of lea-ploughing the seed will grow more or less after the furrow; and the old adage says, "The more seams, the more lice," which is most particularly the case in land of a strong

tough nature. By such deep-ploughing, too, much of the cold inert soil must be brought to the surface, and the active soil near the top, containing the remains of the unexhausted manure, and the roots of decayed vegetation, along with the lea surface, which is invaluable for a crop, are all buried too deep. Some say that most crops are benefited by deep cultivation, which I readily admit, and should think well of, if the cold soil turned up was dressed with manure, to nourish the plants in the first stage of their growth; but otherwise they get stunted, and stop growing before reaching the active soil; and when the growth of a plant is once checked, it seldom thoroughly recovers; so that I should never recommend deep ploughing in any case, without a dose of sharpening manure to the crop. The large rough hollows among the furrows of trench-ploughing prevent the seed from being deposited at a uniform depth; and the consequence is, as I have already shown, that the crop will not ripen equally in harvest. For these reasons I shall dispense with the trench-plough, as an unsuitable implement for the ploughing of lea-land.

Wilkie's High-crested Plough.—Since ploughing-matches have become so numerous, this implement has been much sought after, and highly approved of,—chiefly, I think, from its peculiar system of cutting the furrow-slice at a very acute angle, thereby giving the work a beautiful appearance, and, as ploughmen say, making the furrows *tell.* If beauty be a particular feature in good ploughing, this plough deserves credit, for it makes the best-looking work I ever saw; but as something more than look is required to make a substantially good corn-furrow, I shall just make a short inquiry into its performance below the ground. In all high-cutting ploughs, it is obvious that the mould forming the high crest must come from somewhere, and that a vacancy in lieu thereof must be caused in some other place. I observed that the irons of this plough require to be set, so as to cut deepest at the land side, and a little in below the solid bank of the unploughed land, thus producing mould for the high crest, and a false account of the deepness of the ploughing, when measured only on the land edge of the upturned furrow-slice: supposing such measure to be 6 inches, the opposite side of the furrow will seldom stand more than 4 or $4\frac{1}{2}$ inches deep. An excellent specimen of this deception lately happened to come under my notice, where the furrow-slices of part of a ploughed field were accidentally swept off by the flooding of an adjoining river. The subsoil below the furrows was thus completely exposed, when they presented a serrated appearance as in the diagram, which is meant to show a cross section of the bottoms of the furrows; the land side being supposed to be at the left side of the sketch.



The crooked line A B represents the land below the bottoms of the furrows, and the line C D the supposed appearance of the bottom in all equal ploughing,—every part of the furrows of which ought to be at a uniform depth from the surface. The acute hollows in the line A B at *e f g h i* indicate the tracts made by the land side of the plough. The heights at *k l m n* are supposed to be fast soil passed over by the mould-board side of the plough, and in some of these I measured nearly 2 inches deep of fast mould. This, which is certainly a most *objectionable* system of ploughing for such a hard and uneven bottom, must always prove very detrimental to the crops; and the furrow-slices being always raised with a thick side and a thin, the deepness of loose mould produced must thereby be very unequal. In the capacity of a judge at ploughing-matches, my attention has often been directed (in ploughing of this kind) to the firmness of the furrows under my feet, which is not surprising, seeing they were so thoroughly bolstered up below with a solid ridge of fast mould. High-crested ploughing is by some reckoned a great improvement for stiff land, on the plea that it exposes more of the soil to the ameliorating action of the atmosphere: of this, however, I am very sceptical; for although it raises a much higher crest than rectangular ploughing, it is yet of very small dimensions, and does not contain the same square body of mould. When the land is ploughed before winter, I have seen the high crest mouldered down by the action of frost, till there were scarcely sufficient seams or hollows left to cover in the seed: this does not happen to the same extent by the rectangular cut, which gives a strong square body of mould, capable of standing the action of the weather. To produce a high-crested furrow, the irons are generally set so as to incline cutting a little in below the solid surface of the unploughed land, which tends to make it more ticklish and difficult to hold, and no doubt increases the draught of the horses. The plough is always easiest to hold and draw when it swims fair, with all its parts cutting clean and straight forward.

Small's Rectangular Plough.—The chief merits of this implement consists in its turning over the furrows at one uniform depth, leaving the bottom on the same level as the surface, and thus affording an equal quantity of loose mould for the researches of the whole roots of the crop in quest of food—a very important object. It cuts the furrow-slices in a rectangular form, which affords a firm strong square crest of mould for the harrows to act upon in covering the seed. It is also good for turning the green edge of the lea surface well in between the furrows, packing them closely together, and, upon the whole, makes good solid work. This plough requires

less propelling power than the high-crested one; I have frequently seen them tested against each other by a dynamometer, and the result was always in favour of the rectangular-cutting plough. On talking over the subject with an experienced plough-maker of the *crested* order, he admitted that the irons and gearing of the rectangular plough were easier kept in repair than those of the crested one: of this fact I have had ample proof for three years, when I got two high-crested ploughs, as I am aware that since that time much more smithy work has been required.

From what has been said, it will be seen that I am most in favour of the *rectangular*-cutting plough; it stands the test, in every way I have tried it, far better than the *high-crested* one. I believe there are only two ways in which the plough can be successfully improved: *First*, By making the draught on horses and the labour on men as light as possible, always securing a sufficient depth; *Second*, The sufficiency of the work for crop, which consists in producing the greatest quantity of mould for covering the seed, combined with firm and close-laid furrow-slices, and preserving the subsoil below the furrows on the same level as the surface of the land. This the *high-crested* plough never does perform, and in no other way can a uniform deepness be maintained. For the purpose of pleasing the eye at ploughing-matches, the desire for high-cutting has by plough-makers and ploughmen been carried too far; thus defeating what ought to be the aim of every agriculturist—an improved system of ploughing the land. It is my humble opinion that all plough-makers and ploughmen should endeavour to make the implement cut as near the square as possible; or, in other words, to make it cut the furrow-slices at an angle of 90° to the surface of the land and the bottom of the furrow, and that, whenever they go above or below that angle, they are making a step in the wrong direction.

IMPROVED PLANTER'S TABLE.

By Mr James Craig, Land-Surveyor, Lochwinnoch.

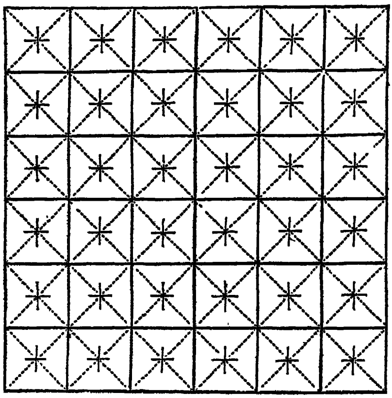
[Premium—The Silver Medal.]

Every one who has planted to any extent must have had occasion to refer to a planter's table, showing the number of trees required for an acre at given distances. The table now commonly in use is as follows, and has for many years regulated the calculations of the forester :—

DISTANCE.	IMPERIAL ACRE.	DISTANCE.	SCOTTISH ACRE.	DISTANCE.	IRISH ACRE.
Feet.	Number.	Feet.	Number.	Feet.	Number.
1	43,560	1	54,760	1	70,560
1½	19,360	1½	24,338	1½	31,360
2	10,890	2	13,690	2	17,640.
2½	6,970	2½	8,761	2½	11,209
3	4,840	3	6,084	3	7,840
3½	3,556	3½	4,470	3½	5,760
4	2,722	4	3,422	4	4,410
4½	2,151	4½	2,704	4½	3,484
5	1,742	5	2,190	5	2,822
5½	1,440	5½	1,810	5½	2,332
6	1,210	6	1,521	6	1,960
6½	1,031	6½	1,296	6½	1,670
7	889	7	1,117	7	1,440
7½	774	7½	973	7½	1,254
8	680	8	855	8	1,102
8½	603	8½	758	8½	976
9	537	9	675	9	871
9½	482	9½	606	9½	782
10	435	10	547	10	705
10½	395	10½	496	10½	640
11	360	11	452	11	583
11½	329	11½	414	11½	533
12	302	12	380	12	490
12½	270	12½	350	12½	452
13	257	13	324	13	417
13½	239	13½	300	13½	385
14	222	14	279	14	360
14½	207	14½	260	14½	335
15	193	15	243	15	316
15½	181	15½	228	15½	292
16	170	16	214	16	275
16½	164	16½	201	16½	260
17	150	17	189	17	244
17½	142	17½	178	17½	234
18	134	18	169	18	217
18½	127	18½	160	18½	206
19	120	19	151	19	195
19½	114	19½	143	19½	185
20	108	20	137	20	176
22	90	22	113	22	146
24	75	24	95	24	123
26	64	26	81	26	105
28	55	28	70	28	90
30	48	30	60	30	79

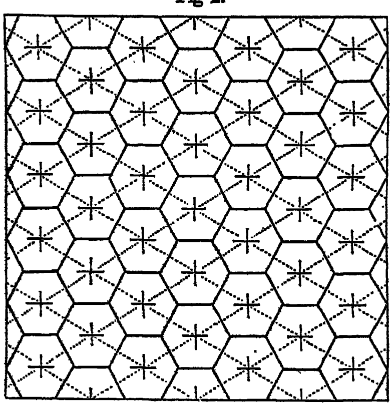
This Table has been frequently found practically to be erroneous, in so far as the planter wished to distribute the trees at equal distances every way from each other —it having been constructed on the supposition that the plants should occupy square spaces, thus (Fig 1.)

Fig 1.



It is evident that on the above principle, the plants are not equidistant from each other in all directions, and the land therefore is not equally taxed. The more exact method is, that the plants should be placed in hexagonal spaces, and thus the soil, which is immediately to contribute to the nourishment of the plant, surrounds it, so as to be at the nearest possible distance from it (Fig 2.) A given space of ground will thus be found to contain a greater number of trees than according to the old principle, each tree being still at the same nominal distance.

Fig 2.



Suppose a plantation to be laid out in rows, and the distances between the plants to be 3 feet; the distances between the *rows*, by the former method of *squares*, will be also 3 feet, whereas by the latter method of *triangular* division, the distances between the rows will be only 2 feet 7 inches (avoiding small fractions), or nearly 7 rows by the latter instead of 6 by the former method.

Moreover, to plant *one acre* at 3 feet apart, instead of 4840 plants by the former calculation, 5588 will be required by the latter; and at 6 feet apart, instead of 1210 plants as by the former calculation, 1397 will be required by the latter. A Table, therefore, representing truly a geometrical distribution of trees, will stand as follows:—

IMPERIAL ACRE.				SCOTTISH ACRE.				IRISH ACRE.			
Distance in Feet.	Number.	Distance in Feet.	Number.	Distance in Feet.	Number.	Distance in Feet.	Number.	Distance in Feet.	Number.	Distance in Feet.	Number.
1	50,300	12	349	1	63,233	12	439	1	81,478	12	565
1½	22,355	12½	321	1½	28,102	12½	404	1½	36,211	12½	521
2	12,575	13	297	2	15,808	13	374	2	20,369	13	482
2½	8,047	13½	275	2½	10,117	13½	346	2½	13,036	13½	447
3	5,588	14	256	3	7,025	14	322	3	9,052	14	415
3½	4,106	14½	239	3½	5,161	14½	300	3½	6,651	14½	387
4	3,143	15	223	4	3,951	15	281	4	5,092	15	362
4½	2,483	15½	209	4½	3,122	15½	263	4½	4,023	15½	339
5	2,011	16	196	5	2,529	16	246	5	3,259	16	318
5½	1,662	16½	184	5½	2,090	16½	232	5½	2,693	16½	299
6	1,397	17	174	6	1,756	17	218	6	2,263	17	281
6½	1,190	17½	164	6½	1,496	17½	206	6½	1,928	17½	266
7	1,026	18	155	7	1,290	18	195	7	1,662	18	251
7½	894	18½	146	7½	1,124	18½	184	7½	1,448	18½	238
8	785	19	139	8	987	19	175	8	1,273	19	225
8½	696	19½	132	8½	875	19½	166	8½	1,127	19½	214
9	620	20	125	9	780	20	158	9	1,005	20	203
9½	557	22	103	9½	700	22	130	9½	902	22	168
10	502	24	87	10	632	24	109	10	814	24	141
10½	456	26	74	10½	573	26	93	10½	739	26	120
11	415	28	64	11	522	28	80	11	673	28	103
11½	380	30	55	11½	478	30	70	11½	616	30	90

By reference to the diagram Fig. 2, it will be obvious that the hexagonal space occupied by each tree is double the area of the equilateral triangle formed by any three adjacent trees. The Table is constructed by dividing the area to be planted by the area of a hexagon whose *perpendicular* is equal to half the distance between the trees: the quotient is the number of trees. In this Table the fractional parts are omitted.

LIST OF PLOUGHING COMPETITIONS *reported to the Society in* 1854-55.

District.	Date.	No. of Ploughs.	Extent.	Time.	Amount of Premiums.	First Premium and Society's Medal Awarded to
Aberdeenshire—						
Drumblade	25 Dec. 1854	19	Rate of 1 acre	in 10 hours	£3 0 0	John Roger, Kirktonmill, Drumblade.
Easter Bo, King-Edward ...	9 Jan. 1855	34	½ acre	in 5 hours	5 14 0	Alexander Smart, farm-servant, Clachforbie.
Ennintur, Leochel Cushnie ...	5 Dec. 1854	24	⅓ acre	in 4 hours	4 7 6	James Dunn, farm-servant, Westerfoulis.
Guise	9 April 1855	58	½ Scotch acre	in 6 hours	3 12 0	James M'Pherson, farm-servant, Tillyfour.
Hillhead	4 Jan. 1855	55	⅓ Scotch acre	in 3½ hours	4 1 6	William Ross, farm-servant, Tarwathie.
Newhills Association	26 Dec. 1854	27	Rate of 1 acre	in 10 hours	4 17 0	John Scorgie, farm-servant, Greenfairns.
Tarbet Hill, Old Machar ...	12 Dec. 1854	38	½ acre	in 4 hours	8 0 0	Alexander Gibb, farm-servant, Denmoir.
Tilinamolt	1 Jan. 1855	29	⅓ Scotch acre	in 3½ hours	3 1 6	Thomas Walker, farm-servant, Killiewharn.
Argyllshire—						
Criganich, Lesmore	15 Mar. 1855	15	¼ acre	in 4 hours	3 0 0	Malcolm Carmichael, Fennacrockan.
Dalrioch, Kintyre	15 Feb. 1854	17	1⅜ roods	in 4 hours	4 9 6	John M'Innes, farm-servant, Killconan.
Inverary Home Farm	20 Mar. 1855	16	½ Scotch acre	in 6 hours	4 0 0	Hugh M'Dougall, farm-servant, Tombreck.
Kintyre Society	9 Mar. 1855	27	64 poles	in 4⅔ hours	4 7 6	
Lorn Society	16 Mar. 1855	15	⅜ acre	in 4 hours	3 0 0	Dugald M'Coll, Culnadallich.
Ditto	14 Mar. 1855	15	⅜ acre	in 4 hours	3 0 0	Hugh M'Coll, Dalachulish.
Ayrshire—						
Chapelton, Largs	14 Mar. 1855	16	Rate of 1 Sc. ac.	in 16 hours	4 18 6	George Kirkland, farm-servant, Springvale.
Coylton Society	23 Mar. 1855	19	1 rood 12 falls Sc.	in 5 hrs. 12 m.	3 15 0	James Caldwell, Knockshoggle.
Fenwick Society	22 Mar. 1855	18	1 rood 10 poles	in 4 hours.	3 3 6	David Stevenson, farm-servant, Brierbush.
Galston Society	20 Mar. 1855	20	Rate of 1 acre	in 16 hours	3 0 0	William Smith, West Ashyard.
Grongar Society	24 Mar. 1855	15	1 rood 7 poles	in 3 hrs. 50 m.	3 13 6	Alexander Mitchell, farm-servant, Hemphill.
Kirkmichael Society	17 Mar. 1855	32	Rate of 1 acre	in 10 hours	3 2 6	John Neil, Goosehill.
Banffshire—						
Carnousie, Forglen	21 Dec. 1854	40	⅓ Scotch acre	in 5 hours	5 0 0	Alexander Fasken, farm-servant, Auldtown.
Berwickshire—						
Cove, Cockburnspath	5 Jan. 1855	23	¾ acre	in 8 hours	3 15 0	James Fairbairn, Wheatacres.
East of Berwickshire Club ...	29 Nov. 1854	18	¾ acre	in 7½ hours	5 7 6	Ebenezer Darling, Nethermains.
Lauderdale Society	10 Mar. 1855	15	2 roods 27 poles	in 6½ hours	4 10 0	William Short, Whitslaid.
Preston, Buncle	12 Jan. 1855	23	⅔ acre	in 6½ hours	4 12 0	James Rae, Primrosehill.
Spottiswoode	23 Dec. 1854	26	½ acre	in 5 hours	4 5 6	James Pringle, farm-servant, Whiteburn.
Upper Dist. Lauderdale Society	16 Jan. 1855	27	½ acre	in 5 hours	4 5 6	David Hamilton, farm-servant, Addinstone.
Buteshire—						
Kames	20 Mar. 1855	47	60 Scotch falls	in 6 hours	5 2 6	John Little, Stravanan.

LIST OF PLOUGHING COMPETITIONS—(*continued.*)

District.	Date.	No. of Ploughs.	Extent.	Time.	Amount of Premiums.	First Premium and Society's Medal Awarded to
CAITHNESS-SHIRE—						
Dunbeath Mains	15 Mar. 1855	29	2 roods 20 poles	in 6 hours	£3 17 6	Andrew Bain, farm-servant, Langwell.
Myrsa	15 Mar. 1855	27	1 rood 32 poles	in 4½ hours	3 15 0	Henry Steven, farm-servant, Myrsa.
DUMBARTONSHIRE—						
Cardross	9 Mar. 1855	18	38 falls Scotch	in 4 hrs. 5 m.	7 10 0	James Cameron, farm-servant, Cardross Mill.
EDINBURGHSHIRE—						
Arniston, Borthwick	15 Dec. 1854	33	½ acre	in 5 hours	5 10 0	Thomas Neilands, farm-servant, Halkerston.
Bonnington	22 Dec. 1854	70	½ Scotch acre	in 7½ hours	3 0 0	Peter Gray, farm-servant, Lanton.
Carrington Association, Whitehill	26 Dec. 1854	22	Rate of 1 acre	in 10 hours	4 2 0	Thomas Kerr, farm-servant, Carrington Barns.
Esperston, Temple	16 Dec. 1854	36	½ acre	in 5 hours	3 7 6	Andrew Paton, farm-servant, Yorkston.
Gavieside	9 Jan. 1855	20	½ acre	in 5 hours	3 13 0	John Elder, Bent.
Gourlaw, Whitehill	16 Jan. 1855	31	Rate of 1 acre	in 10 hours	4 19 6	John Anderson, farm-ser. to Duke of Buccleuch.
Inveresk Society	8 Jan. 1855	30	¾ acre	in 7½ hours	3 6 0	Archibald Shearer, Dalkeith Park.
Parduvine	16 Dec. 1853	23	½ acre	in 5 hours	4 9 0	Thomas Kerr, farm-servant, Carrington Barns.
Whitehill Assoc., Shewington	22 Dec. 1854	22	½ acre	in 5 hours	4 10 0	Robert Haig, farm-servant, Rosewell.
FIFESHIRE—						
Beath Society	6 Dec. 1854	23	½ acre	in 5 hours	3 3 0	John Blythe, farm-servant, Shields.
Crossgates Society	15 Dec. 1854	21	½ acre	in 7 hours	3 2 6	George Craigie, farm-servant, Balbougie.
Largo Society, ...	22 Dec. 1854	27	½ Scotch acre	in 5½ hours	3 5 6	William Latta, farm-servant, Pitcruvie.
Leslie District Society ...	4 Jan. 1855	29	½ Scotch acre	in 6 hours	3 14 0	David Craig, farm-servant, Macedonia.
FORFARSHIRE—						
Panmure	13 Dec. 1854	42	½ acre	in 5 hours	5 15 0	James Miller, farm-servant, Barons.
Old Montrose	5 Mar. 1855	84	½ acre	in 5 hours	5 17 6	Alexander Gair, Leuchland.
HADDINGTONSHIRE—						
Dunbar Club	8 Mar. 1855	46	¾ acre	in 6 hours	3 19 0	Peter Guilar, farm-servant, Hedderwickhill.
INVERNESS-SHIRE—						
Mains of Glentruim, Laggan ...	7 April 1855	17	Rate of 1 acre	in 10 hours	5 8 0	Donald Macintosh, Milton Cottage.
KINCARDINESHIRE—						
Cassie Port, Banchory-Devenick	26 Dec. 1854	37	Rate of 1 acre	in 10 hours	8 1 0	David Collie, farm-servant, Findon.
Cookston, Nether Banchory ...	29 Mar. 1855	49	1 rood 30 poles	in 4½ hours	5 1 0	John Shepherd, Cairnrobin.
Fettercairn Club	9 Dec. 1854	82	⅓ Scotch acre	in 4½ hours	5 14 0	John Arbuthnott, farm-servant, Bogmuir.
Heathcot, Maryculter ...	16 Jan. 1855	57	Rate of 1 acre	in 10 hours	8 10 6	Andrew Donald, farm-servant, Tollohill.
Monquich, Fetteresso	2 Jan. 1855	19	Rate of 1 acre	in 10 hours	3 0 0	Robert Duncan, farm-servant, Rothwick.
Wardend of Durris	12 Dec. 1854	42	⅓ acre	in 3⅓ hours	5 7 6	Charles M'Hardy, Cairnfauld.

LIST OF PLOUGHING COMPETITIONS—(*continued.*)

District.	Date.	No. of Ploughs.	Extent.	Time.	Amount of Premiums.	First Premium and Society's Medal Awarded to
LANARKSHIRE—						
East Kilbride Society	27 Mar. 1855	15	Rate of 1 Sc. acre	in 17 hours	£8 5 6	Thomas Ballantine, Netherton.
Old Monkland Society ...	23 Mar. 1855	35	Rate of ½ acre	in 6½ hours	10 0 0	William Weir, Lochfaulds.
ORKNEY—						
Stone, Sanday	23 Mar. 1855	15	2 roods 2½ poles.	in 5½ hours	3 0 0	Magnus Tulloch, farm-servant, Hammerbreak.
Waltness, Shapinshay	8 Mar. 1855	28	2 roods 23 poles	in 6 hours	3 7 0	Sinclair M'Adie, farm-servant, Sound.
PERTHSHIRE—						
Auchterarder Society	14 Mar. 1855	18	Rate of 1 acre	in 10 hours	3 0 0	William Taylor, farm-servant.
Blairdrummond Club	3 Dec. 1854	33	Rate of 1 Sc. acre	in 16 hours	4 0 0	Duncan M'Kerracher, farm-servant, Dasherhead.
Braco	2 April 1855	15	⅓ Scotch acre	in 5 hours	3 0 0	James Kinross, farmer, Hungryhill.
Breadalbane	30 Mar. 1855	19	.459 acre	in 6½ hours	3 0 0	John M'Laren, farmer, Machrum.
Easter Carie, Rannach ...	12 April 1855	26	2 roods	in 5 hours	3 0 0	John M'Gregor, Aulick.
Freeland, Forgandenny ...	16 Dec. 1854	35	¾ Scotch acre	in 6 hours	5 0 0	John Brough, farm-servant, Oudenard.
Knockbarrie, Moulin	9 April 1855	16	½ acre	in 5 hours	3 2 6	John Campbell, Balnadrum.
Methven Society	4 Jan. 1855	27	2 roods 18 pls. Sc.	in 6 hours	3 10 6	John Graham, farm-servant, Cairnies.
Moness, Aberfeldy	20 April 1855	25	1 rood 32 poles	in 6½ hours	3 1 0	John M'Dougall, Kinigallen.
St Martin's Society	3 Feb. 1855	25	½ Scotch acre	in 6 hours	5 0 0	Alexander Macfarlane, West Gardrum.
Weem	26 Mar. 1855	29	½ acre	in 5 hours	4 5 0	William Menzies, farm-servant, Tirinie.
RENFREWSHIRE—						
Mearns Society	20 Mar. 1855	18	Rate of 1 Sc. acre	in 18 hours	3 13 0	John Boreland, Waterfoot.
Patterton, Eastwood	16 Jan. 1855	17	Rate of 1 acre	in 12½ hours	5 5 0	Alexander Aikenhead, Carnwadrick.
Renfrewshire Society, ...	23 Mar. 1855	35	Rate 1 Sc. acre	in 18 hours	7 15 0	William Watson, Sheeppark.
ROSS-SHIRE—						
Easter Ross Club	13 Jan. 1855	84	½ acre	in 5 hours	8 6 0	Donald Ross, Arboll.
Keppoch	16 Mar. 1855	20	½ acre	in 4 hours	3 5 0	Alexander Ross, Humberston, Dingwall.
ROXBURGHSHIRE—						
Greenwells, St Boswells ...	6 Jan. 1855	38	½ acre	in 5 hours	5 12 6	James Plenderleith, Gladswoode.
Union Agricultural Society, ...	8 Mar. 1855	47	¾ acre	in 6 hours	17 13 0	Thomas Howie, Whitehill Foot.
STIRLINGSHIRE—						
Gargunnock Club	8 Mar. 1855	27	Rate of 1 Sc. acre	in 16 hours	5 0 0	Duncan M'Kerracher, Dasherhead.
Logie and Lecropt Society ...	8 Mar. 1855	23			3 8 6	Andrew Ferguson, farm-servant, Manorneuck.
Miretown, Alva	5 Mar. 1855	27			8 2 6	John Seaton, farm-servant, Balquharn.
Stewarthall	15 Mar. 1855	30	⅓ Scotch acre	in 4 hours	3 16 0	John Mackay, farm-servant, Bandeath.
SUTHERLANDSHIRE—						
Dunrobin Mains	13 Mar. 1855	33	½ acre	in 5 hours	5 10 0	George Reid, farm-servant, Culmaily.

PROCEEDINGS IN THE LABORATORY.

By Professor ANDERSON, M.D., Chemist to the Society.

ON THE COMPOSITION AND FEEDING VALUE OF DIFFERENT VARIETIES OF LINSEED CAKE.

THAT the practice of agriculture is influenced by extraneous circumstances to a greater extent than that of any other art, is a position too obvious to admit of any question. Daily experience shows us that the best-founded hopes of the farmer are liable to be destroyed by the vicissitudes of the weather, and a hundred other causes which it is impossible to foresee or to guard against; and hence in all ages the art of agriculture has been stamped with the character of uncertainty. But while this is strictly true as a general statement, we have only to examine the nature of farming operations as carried on at the present day, to see that it does not apply with equal force to all its different departments. In fact, the practice of agriculture embraces two very distinct subdivisions—the cultivation of the soil, and the feeding of cattle; and of these the former, under the old system of agriculture, enjoyed a special pre-eminence, while the latter was looked upon as entirely subordinate to it. If we keep this subdivision prominently before us, we cannot fail to perceive that it is to the cultivation of the soil that the character of uncertainty more peculiarly belongs; and the feeding of stock, as now practised, is in certain points of view less uncertain, and more easily brought within rule, than the cultivation of our crops. We take the cattle which we propose to fatten, place them in well-constructed buildings, in which an equable temperature is maintained; by the exclusion of light, and confinement in a narrow space, we prevent them from expending in muscular action the food which ought to be converted into flesh and fat; and, finally, we supply them with the kinds and quantities of food which are best suited to fulfil the objects we have in view; so that if our cattle are healthy, and escape the ravages of epidemic disease, we ought to reduce the process of feeding to one of comparative certainty. To insure all this, however, we must first have established the principles involved in the fattening of cattle, and have ascertained the exact nature and composition of the different sorts of food with which we supply them. It cannot certainly be asserted that all this has as yet been effected; but a comparison of the practice of feeding, forty or even twenty years since, with that employed by the most skilful farmers of the present day, affords abundant evidence that in no department of agriculture have more rapid strides been made. Science and practice have combined to produce this effect; the former by the analysis of various substances

employed as food; the latter by careful experiments, often of a very elaborate character, on the fattening effect of different nutritive matters of known composition. Numerous, however, as these experiments have been, the subject is far from being exhausted. It is not by a single, or even by a few experiments that we can hope to establish, in a definite manner, all that we require to know; an immense mass of facts must be accumulated, our observations varied in every point of view, and great caution must be exercised in drawing our conclusions.

The necessity for an accumulation of experiments has made itself strongly apparent to myself in connection with the determination of the feeding values of different substances. One of the great problems on which I set to work, soon after my connection with the Highland Society commenced, was the formation of a table of the feeding value of different substances, which I anticipated might be produced without any very great amount of labour. A very little experience, however, was sufficient to show how fallacious this anticipation was; and it became obvious that the value of each substance required to be determined, not by one, but by many experiments; and though a short table of feeding values has been published in the Society's Transactions, it must be considered as entirely provisional, and liable to undergo appreciable corrections by more extended experiments. The accumulation of facts for this purpose has never been lost sight of, and from time to time papers treating of the value of individual substances have appeared. The present is intended to add to our knowledge of the composition of linseed cake.

Analyses of linseed cakes have already been published by Professor Way, by myself, and isolated analyses have been made by other experimenters. Professor Way's analyses, which were published some time since, were confined to the determination of the amount of nitrogen, oil, and ash; and in others which have been published in the Society's Transactions, a determination of the proportion of phosphates of the alkaline earths, and of the phosphoric acid combined with the alkalies, was superadded. In the present paper, an attempt has been made to extend this to the determination of the quantity of woody fibre, which enables us to deduce some further facts which are not without considerable importance.

In order to render intelligible what is to follow, I think it advisable to premise a few observations on the nature of the constituents of linseed cake, and of the food of animals in general. It must be remembered, then, that the chemical constituents of all foods belong to two great classes—the nitrogenous and the non-nitrogenous. The former embrace a variety of substances, known under the name of gluten, vegetable fibrine, caseine, hordeine, avenine, &c.; all similar, if not identical, in composition, though

characterised by properties which enable us readily to distinguish them from one another. These substances are not only similar to one another in composition, but they appear also to be identical with the nitrogenous constituents of animals. It is in these forms that the whole of the nitrogen is supplied to the animals; and hence their peculiar nutritive function is to promote the formation of muscular flesh. The non-nitrogenous constituents of food are divisible into two, or more correctly, perhaps, into three sections. Of these the first embraces the fatty matters, to which the exclusive power of producing fat was at one time attributed. Later researches, while in no degree diminishing the importance of that great class of organic compounds in promoting the accumulation of fat, has shown that the other subdivision of the starchy or saccharine substances is scarcely, if at all, inferior to the fatty matters in this point of view. It has, in fact, been satisfactorily established that sugar, starch, and gum are capable of replacing the fatty matters in producing fat, although it is not probable that they do this to any great extent, if a sufficient quantity of the latter exist ready formed in the food. Yet these saccharine matters are essential to all highly nutritive foods, because, along with the oleaginous substances, they serve to sustain the animal heat, and may be looked upon as the prime movers of the animal machine.

But no food supplied to cattle consists exclusively of the three great classes of constituents already named. There is present in all a certain proportion—most abundant in stems, least so in the seeds—of a substance destined to confer rigidity upon the plant, and to give support to its various organs, and which, under the name of lignine or woody fibre, is familiar to us as the main constituent of the trunks of trees. This substance, allied in constitution to the starchy matters, is yet distinguished from them by its extreme inertness and insolubility, which prevents its acting as a nutritive substance. Its presence, therefore, in any food necessarily diminishes its value; and it does so, not merely by reducing the quantity of really valuable matters, but likewise by forming an inert and insoluble envelope, which protects those actually present from the solvent action of the juices of the stomach.

If we take into consideration the facts just stated, it must be obvious that, to obtain a complete idea of the nutritive value of any food, it is necessary separately to determine the proportion of nitrogenous, starchy or saccharine, fatty, and mineral matters; that is to say, we must ascertain the exact quantity of each great subdivision of nutritive matters. It is not necessary for practical purposes, however interesting it might be in other points of view, to establish the proportion of the individual constituents of each group. Thus, supposing any sort of food to contain both starch and sugar, a determination of the quantities of each is not required, provided we know the sum of the two; for we may consider it

certain that these substances, having the same nutritive function, may replace one another. The degree of accuracy with which the quantities of the different substances can be ascertained is very variable. Oil and nitrogenous matters, and the constituents of the ash, can be determined with great precision; but the properties of the starchy and saccharine matters are such, that no method has yet been devised by which they can be estimated in a rapid and precise manner; and in examining the composition of the turnip, I found that the best and most available method of directly determining the quantity of sugar was so extremely incorrect that it was at once abandoned. The only mode in which it is possible to ascertain the proportion of the starchy and saccharine matters is by estimating all the other constituents, and assuming the difference to consist entirely of those substances; and for this purpose, an estimation of the woody fibre becomes necessary. Unfortunately, however, the method by which this is done does not possess very great precision. That which I have employed consists in digesting the substance first with weak solution of caustic potass, and then with a dilute acid, generally hydrochloric; but I have found that this process is liable to some degree of uncertainty, and that a good deal depends upon the experimenter. It seems of especial importance that the potash should be employed in a dilute state, and the digestion continued for a considerable time; and if sufficient attention be paid to this point, the results appear to deserve some degree of confidence: but it is obvious that, at the best, they must be greatly inferior in accuracy to the direct determination,—all the errors of experiment being accumulated upon this one class of substances; and unless great care be exercised in determining the fibre, it is manifest that the errors may become extremely large.

The analyses contained in this paper were performed in the following manner: A portion of the cake, carefully powdered, was dried at 212°, and the loss of weight estimated. Another portion was ignited in a platinum crucible for the ash, which was afterwards dissolved in hydrochloric acid, the silica separated, and the fluid rendered alkaline by ammonia. The precipitate thus obtained was weighed; it consisted of phosphates. The phosphoric acid remaining in combination with the alkalies was then precipitated by means of sulphate of magnesia. The oil was estimated by digesting the cake in successive quantities of ether, which was then distilled off in a small flask, and dried by exposure to a heat of 212° for some days. The albuminous or nitrogenous compounds were deduced from the nitrogen determination made by a modification of Peligot's method, which I have found at once convenient and accurate. For the woody fibre, a quantity of cake, amounting to from 50 to 70 grains, was digested for some days with dilute caustic potash, which was then removed, the residue washed, and

again digested with a dilute acid, if the resulting fibre did not then appear colourless. The quantities of these substances being added together, the amount required to make up 100 parts was taken to represent the quantity of saccharine and starchy matters, and of the mucilage covering the external part of the seed, which is undoubtedly an important member of that class of nutritive matters.

Oil-cakes of British manufacture.—The number of samples of British manufacture which I have examined is not large; and in only two, both manufactured in Hull, has the amount of fibre been determined. Their results were—

	I.	II.
Water,	11.87	10.17
Oil,	10.08	10.75
Albuminous compounds,	26.04	28.00
Saccharine and mucilaginous compounds,	41.90	36.13
Fibre,	4.24	8.53
Ash,	5.87	5.42
	100.00	100.00
Nitrogen,	4.14	4.46

The ash contains—

Earthy phosphates,	3.13	3.03
Phosphoric acid combined with the alkalies,	0.31	0.09

In the following analyses of cakes from other localities, the amount of fibre was not determined, and it consequently appears along with the starchy and mucilaginous matters :—

	Dublin.	Liverpool.	Liverpool.	Belfast.	Belfast.
Water,	10.56	10.64	10.11	11.28	10.77
Oil,	12.88	16.07	14.37	13.07	13.13
Albuminous compounds,	32.70	29.18	32.39	26.98	24.05
Saccharine and mucilaginous matters and fibres,	36.71	37.06	38.22	43.83	46.16
Ash,	7.15	7.05	4.91	4.84	5.89
	100.00	100.00	100.00	100.00	100.00
Nitrogen,	5.20	4.64	5.15	4.29	3.83

The ash contained—

Earthy phosphates,	3.55	3.80	2.36	2.16	2.95
Phosphoric acid combined with the alkalies,	0.36	0.60	0.19	0.36	0.26

These analyses would seem to indicate some slight degree of inferiority in the Hull cake, which contains a smaller quantity both of albuminous matters and oil than any, except the last. They are interesting also, in so far as they serve to dispel a prejudice against Irish cake, which I have more than once heard expressed here; for that manufactured in Dublin is of high quality, and though one of the Belfast samples is decidedly inferior, the other is tolerably good.

Copenhagen oil-cake.—Two samples of Copenhagen oil-cake have been examined, one imported into London, the other into Leith.

	I.	II.
Water,	12.55	12.24
Oil,	12.42	12.01
Albuminous compounds,	31.26	28.24
Saccharine and mucilaginous matters,	33.81	36.04
Fibre,	3.81	4.68
Ash,	6.15	6.79
	100.00	100.00
Nitrogen,	4.97	4.49

The ash contained—

Earthy phosphates,	2.96	2.80
Phosphoric acid combined with the alkalies,	0.33	0.27

Flensburg oil-cake.—The cake manufactured at Flensburg has long enjoyed a high reputation for its superior quality and the care with which it is manufactured. Its celebrity has, however, of late years somewhat declined, and apparently not without cause, for the subjoined analyses do not give it a very high quality. The quantity of fibre contained in both samples is large, and in the first the amount is so remarkable, that I am inclined to think either that the sample must have been adulterated, or that some error may have been committed in the determination of the fibre, which, it has been already mentioned, is open to some degree of uncertainty. As the sample is, in other respects, of inferior quality, it is not improbable that adulteration may really have been practised. Nothing remarkable was observed in the appearance of the cake, and the sample having been mislaid, I am unable to repeat the analysis.

	I.	II.
Water,	10.83	12.07
Oil,	11.89	12.58
Albuminous compounds,	23.04	26.06
Saccharine and mucilaginous matters,	19.98	28.00
Fibre,	28.47	14.31
Ash,	5.79	6.98
	100.00	100.00
Nitrogen,	3.67	4.15

The ash contains—

Earthy phosphates,	2.57	3.16
Phosphoric acid combined with the alkalies,	0.45	0.13

Swedish cake from Malmoe.—Of this variety the quantity imported is not large. The single sample I have examined is of excellent quality.

Water,	10.43
Oil,	9.46
Albuminous compounds,	31.32
Saccharine and mucilaginous matters,	36.71
Fibre,	4.38
Ash,	7.70
	100.00
Nitrogen,	4.98

The ash contains—

Earthy phosphates,	3.27
Phosphoric acid,	0.25

Konigsberg oil-cake.—The sample analysed was imported into Hull. It proves of inferior quality as regards albuminous matters, but the quantity of mucilaginous and saccharine substances is large.

Water,	10.03
Oil,	10.88
Albuminous compounds,	21.63
Saccharine and mucilaginous matters,	46.64
Fibre,	4.36
Ash,	6.46
	100.00
Nitrogen,	3.44

The ash contains—

Earthy phosphates,	2.96
Phosphoric acid combined with the alkalies,	0.30

Sonderberg oil-cake.—The sample analysed was imported into Leith. The quality, though fair, is not above the average.

Water,	10.49
Oil,	10.40
Albuminous compounds,	26 81
Saccharine and mucilaginous matters,	41.28
Fibre,	5.19
Ash,	5.83
	100.00
Nitrogen,	4.27

The ash contains—

Earthy phosphates,	2.62
Phosphoric acid combined with the alkalies,	0.51

Marseilles cake.—In this variety the expression of the oil has been carried further than in any of the previous samples, and hence the sample, though greatly under the average in oil, is particularly rich in albuminous matters.

Water,	10.71
Oil,	6.53
Albuminous compounds,	34.66
Saccharine and mucilaginous matters,	33.46
Fibre,	6.80
Ash,	7.84
	100.00
Nitrogen,	5.52

The ash contains—

Earthy phosphates,	2.80
Phosphoric acid combined with the alaklies,	0.52

Naples and Venice oil-cakes. — These two varieties resemble that from Marseilles in containing a small proportion of oil, and are consequently rich in nitrogenous matters. They are very rarely imported into Scotland, but are valuable varieties.

	Naples.	Venice.
Water,	10.59	11.88
Oil,	8.07	7.17
Albuminous compounds,	29.64	33.84
Saccharine and mucilaginous matters,	37.95	37.80
Fibre,	6.59	3.23
Ash,	7.16	5.88
	100.00	100.00
Nitrogen,	4.72	5.38

The ash contains—

Earthy phosphates,	1.06	3.10
Phosphoric acid combined with the alkalies,	0.24	0.27

American oil-cake.—Oil-cake is imported into this country from several American ports, and the quality of the article varies considerably. Eight samples were analysed. They were described as follows:—

1. Ohio round cakes.
2. Western.
3. Boston.
4. North American.
5. Do.
6. Albany.
7. Finest American, imported in barrels.
8. Do. do.

This analysis gave—

	I.	II.	III.
Water,	8.70	9.08	8.80
Oil,	13.17	15.67	13.47
Albuminous compounds,	30.94	28.45	28.32
Mucilaginous and saccharine matters,	37.54	35.79	33.82
Fibre,	4.48	5.52	8.37
Ash,	5.17	5.49	7.22
	100.00	100.00	100.00
Nitrogen,	4.92	4.53	4.51

The ash contains—

Earthy phosphates,	2.93	2.77	2.45
Phosphoric acid combined with the alkalies,	0.23	0.75	0.06

	IV.	V.	VI.	VII.	VIII.
Water,	9.32	9.76	8.54	9.96	9.72
Oil,	11.59	9.57	16.15	10.96	13.18
Albuminous compounds,	26.00	29.50	27.17	27.82	28.07
Mucilaginous and saccharine matters,	38.02	45.44	41.29	29.05	31.20
Fibre,	7.83			15.73	12.27
Ash,	7.24	5.73	6.85	6.48	5.56
	100.00			100.00	
Nitrogen,	4.14	4.69	4.32	4.43	4.47

The ash contains—

Earthy phosphates,	2.52	2.88	3.15	2.63	2.36
Phosphoric acid combined with the alkalies,	0.33	0.26	0.45	0.14	...

All these cakes are characterised by the presence of a larger proportion of oil than is usually met with in those of European manufacture, and the general quality is good.

An examination of the results of the preceding analyses shows that the *average* composition of the cakes from different localities does not differ to any great extent; and the subjoined table, giving the average amount of oil, albuminous and saccharine matters in those cakes, of which more than one sample has been analysed, will suffice to render this obvious.

	No. of Analyses.	Oil.	Albuminous matters.	Saccharine matters.
British,	7	12.90	28.47	39.01
American,	8	12.96	28.28	34.22
Copenhagen,	2	12.21	29.75	34.92
Flensburg,	2	12.23	24.55	23.99
Italian,	2	7.67	31.74	37.87

As far as the first four of these varieties are concerned, it is manifest that their composition is so similar, that it may for all practical purposes be termed identical; the proportion of oil and albuminous matter in no case varying to the extent of much more than 1 per cent. The Swedish, Sonderberg, and Konigsberg cakes contain a somewhat smaller quantity of oil—averaging about 10 per cent; and the latter falls materially short in the quantity of albuminous matters. The Italian and French cakes are remarkable for the small proportion of oil which they contain, and, as a necessary consequence, by the proportionate increase in the albuminous compounds. The quantity of oil averages about 7 per cent; and it is remarkable that Professor Way, in his analyses, found Sicilian cake to give, on the average, 6.80 per cent of oil, although he found as much as 11.84 in Italian cakes. *A priori* we should have anticipated the smallest proportion of oil in home-made cake, as in most cases the machinery employed in the oil-mills of this country is much superior to that used abroad.

Although we find that, when the average is taken, all cakes are tolerably similar, matters are altered when individual samples are compared, for then the differences become very material. Comparing, for instance, the different samples of American cake, we find that the oil varies from 9.5 up to 16.17 per cent; that is to say, by nearly 30 per cent of the whole; and similarly the albuminous compounds fluctuate between 26 and 31 per cent. As a general rule, the higher the oil the lower the albuminous matters;

but frequent exceptions are found, as some cakes are observed to be remarkably rich in both. The estimation, however, of the feeding value of the different samples is a matter attended with some degree of difficulty, and must turn upon the point whether the oily or the albuminous compounds are most important in promoting the fattening and growth of cattle. At one time we held that the latter deserved the preference, and that they might be correctly taken as the measure of the value of any sort of food. We now know that this is not absolutely correct, for it has been distinctly recognised that a proper proportion must subsist between the different classes of nutritive matters; so that if we had a food containing abundance of albuminous matters, it would be of inferior value, unless a proper quantity of oily and saccharine matters were also present. In estimating the value of a linseed cake, it appears to me that we must take into consideration both substances, but that the greatest weight is to be attached to the albuminous compounds; thus, for example, the first sample of American cake, containing 13 of oil and about 31 of albuminous matters, and the Dublin cake, are to be preferred to any of the other samples.

By a careful comparison of the results throughout, the reader will have little difficulty in arranging the samples in the order of their value, as deduced from their composition. But when we come to inquire into the market price, it becomes obvious that their commercial value is estimated in an entirely different manner. A striking example is found among the American cakes, of which the first, and chemically the most valuable, was sold, about a year and a half since, at £10 per ton; while the seventh sample, described as the finest American, cost at the same time £12; so that in this case, not only was the price 20 per cent higher than that of No. 1, but it was actually paid for an inferior article. The value of cake is estimated, commercially, very much by its external-characters—such as colour, taste, hardness, and uniformity of appearance; and these characters are not to be undervalued, for they are excellent indications of the condition of the seed from which the cake has been manufactured, and it is manifest that a preference is to be given to those produced from clean and well-harvested seed; but an implicit and exclusive reliance on them must frequently lead to most fallacious results, and causes really valuable samples to be overlooked.

An idea commonly exists that linseed cake is frequently adulterated; but it is certainly erroneous. The oil-presser has nothing to gain by adulteration, for the oil is to him a much more important article than the cake from which it is extracted, and his aim is to obtain as large a quantity of the former as possible—an object which would be defeated by the intermixture of other substances, which would increase the difficulty of expressing, and carry with it other inconveniences. The only method of adding to the weight of the

cake is to increase the quantity of water mixed with the seed before pressing; but this addition must necessarily be confined within very narrow limits, and is practised less as an adulteration than with the view of obtaining a larger yield of oil in the press. From what has been said, it will be obvious that the farmer need feel little fear of loss from adulteration of linseed cake; indeed, I have seen only one instance in which anything of the sort could be suspected, and this was a sample of ground, or rather broken cake, which gave the following results:—

Water,	9.76
Oil,	9.38
Albuminous matters,	24.20
Mucilaginous and saccharine matters and fibre,	47.30
Ash,	9.36
	100.00
Nitrogen,	3.87

The ash contained—

Earthy phosphates,	3.64
Phosphoric acid combined with alkalies,	0.10

The sample was obviously impure, and contained dirt, stones, and pieces of wood; and yet it will be observed that, excepting the slight increase in the per-centage of ash, and the rather small proportions of other valuable matters, there is no very strong evidence of its impurity. It is right, however, to mention, that it apparently contained some other seed, though I was unable, in its crushed state, to recognise it. I did not ascertain anything regarding its history.

But while adulteration is not to be found, great care ought to be exercised in the selection of the individual samples of cake to be used; and the foregoing analyses give instances where upwards of 20 per cent of the whole cost may be saved in this way; and the purchaser should never be content with the mere appearance of the article, but should endeavour to ascertain its composition also.

Intimately connected with the composition of linseed cake is that of rape cake, which now forms an important item of cattle food. It may be of interest to add two analyses, one of Danish, the other of a Hamburg sample:—

	Danish.	Hamburg.
Water,	8.81	9.08
Oil,	10.82	10.96
Albuminous compounds,	33.27	35.60
Mucilaginous and saccharine matters,	28.99	28.44
Fibre,	11.66	8.97
Ash,	6.45	6.95
	100.00	100.00
Nitrogen,	5.29	5.66

The ash contained—

Earthy phosphates,	3.57	3.72
Phosphoric acid combined with the alkalies,	0.42	0.66

Analyses of Dantzic, Stettin, and Bohemian rape-cake will be found in the Transactions for 1853, and the results agree generally with those now given, and indicate a very high feeding value for the cake; a value which, however, is somewhat diminished by the difficulty there is, in the first instance, in inducing sheep, and more especially cattle, to eat it.

COMPOSITION OF BURNT BONES IMPORTED FROM SOUTH AMERICA.

During the present season several cargoes of burnt bones have been imported into this country from the middle district of South America. They are said to be obtained from the great slaughtering establishments there; and as their quality appears to be variable, it may be well to place on record an analysis of two portions of one cargo, which may serve as a guide to those who propose purchasing such bones. The cargo consisted partly of bones in lumps and partly of fine dust, the latter containing a very considerable quantity of sand. The composition of the two portions was—

	Lump-bones.	Bone-dust.
Water,	2.87	3.98
Charcoal,	2.17	4.60
Phosphates,	63.68	4.000
Carbonate of lime,	15.89	11.90
Alkaline salts,	2.54	2.29
Sand,	12.85	37.23
	100.00	100.00
Ammonia,	0.24	0.60

It is quite clear that the lump-bones are tolerably free from foreign matters, while the dust is extremely impure; and it is of some importance that this should be distinctly understood, because the unwary purchaser is apt to give a preference to the powder, as it is more readily applied, and from its state of division more likely to act rapidly upon the crop. The difference in value of these two samples is, however, very considerable, and it may be easily calculated if we bear in mind the price of phosphates and of ammonia. The price of phosphate of lime is about ¾d. per lb., and by an easy calculation we find that every per cent of phosphates contained in any substance is equivalent to 1s. 5d. per ton. Suppose, then, we wish to ascertain the value of the phosphates in these analyses, we have only to multiply in the first, 63 by 1s. 5d., when we find the value to be £4, 9s. per ton, and the dust in the same way proves to be worth only £2, 16s. The slight superi-

ority in the quantity of ammonia contained in the latter is not sufficient to produce any material effect upon its value; but if we compare them with unburnt bones, we perceive that in that case the value is materially enhanced by the presence of even a few per cent of that substance. The price of ammonia is usually about 6d. per lb.; and at this rate we find that every per cent of ammonia adds to the price of the substance rather more than 11s. per ton; but for the last two years, owing to the high price of manure, its value has been about 8d. per lb., in which case every per cent is worth about 14s. 8d. The following analysis of ground bones may serve as an illustration of how this modifies their value:—

Water,	8.96
Organic mater,	28.78
Phosphates,	45.09
Carbonate of lime,	11.94
Carbonate of magnesia,	1.11
Sand,	4.12
	100.00
Ammonia,	3.46

At 6d. per lb. for ammonia, this sample is worth £5, 2s. per ton, and at 8d. it amounts to £5, 15s., so that the unburnt bones are more valuable than the burnt. It must not be forgotten that these sums represent the intrinsic value of the substances, and that the cost of reducing them to powder must be added in order to obtain their selling price.

Another sample of bone-charcoal, also I believe from South America, was found to be of comparatively small value, Its analysis gave—

Water,	16.40
Organic matter,	20.93
Phosphates,	30.78
Carbonate of lime and magnesia,	10.84
Sand,	21.05
	00.100
Ammonia,	1.51

In this case the bones had been imperfectly burnt, and hence a quantity of organic matter, retaining 1.5 per cent of ammonia, remained, and the value per ton is £2, 18s. 6d., or £3, 4s., according as the high or low value of ammonia is taken as the standard. The preceding facts may serve to induce some caution in the purchase of bone-charcoal. It is an excellent, and when of good quality, a cheap source of phosphates, but its composition is so variable that it should never be bought until its quality has been satisfactorily ascertained.

COMPOSITION OF SOME NEW VARIETIES OF GUANO.

The discovery that the supply of Peruvian guano, which we had supposed to be almost inexhaustible, was likely to terminate at no distant time, has caused a very careful search for increased supplies, and a considerable number of new guanos have lately been imported into this country. None of those which I have yet seen fulfil the great desideratum of an ammoniacal guano completely capable of replacing Peruvian, but some of them are valuable additions to our former supplies. That which has been most extensively imported is Mexican guano, and a considerable quantity of it must have reached this country during the past year. At its discovery very great expectations were entertained of its proving important, but the result has not verified our anticipations, for such cargoes as I have examined have proved of very inferior quality. The following analyses may illustrate its composition:—

Water,	20.53	17.57
Organic matter and ammoniacal salts,	7.59	7.08
Phosphates,	31.69	58.32
Carbonate of lime,	36.06	14.17
Alkaline salts,	5.63	2.45
Sand,	0.00	0.41
	100.00	100.000
Ammonia,	0.43	0.84

It may therefore be fairly compared with the inferior Patagonian guano; and if these samples represent its general composition, which there is no reason to doubt, it ought to be carefully avoided. The price charged for it is considerable, and certainly greatly above its value; in fact, if we calculate in the ordinary way, we find that the first sample is not worth more than £2, 10s. per ton, yet large quantities have been sold for £7 or £8.

Columbian guano.—I have recently examined a sample of guano of considerable interest and value, and which is likely to become an article of import in large quantities. It is described as Columbian guano, and consists of grey stony masses, so hard as to require a pretty smart blow with a hammer to break them. The fracture is close-grained and uniform, but the exterior of the masses is very irregular, and varies considerably in colour. Before being used it will require to be ground to powder, an operation which costs about £1 per ton. Its composition is—

Water,	1.03
Organic matter and ammoniacal salts,	6.78
Phosphates,	75.69
Alkaline salts,	4.91
Sand,	11.64
	100.00
Ammonia,	0.11
Phosphoric acid in alkaline salts, Equal to 1.68 phosphate of lime,	0.78

It belongs to the class of phosphatic guanos, of which it is a very valuable example, the quantity of phosphates being larger than in any other variety of guano with which I am acquainted, and about 10 per cent higher than in the best Saldanha Bay guano. It ought, therefore, to sell at a price about one-eighth above that of Saldanha Bay; but in this must be included the cost of grinding, which, as already mentioned, will be about £1 per ton. The importation of this guano has not yet commenced, but a large cargo, I believe, is now on its way to this country; and should it prove equal to the sample, and be sold at a moderate price, it will doubtless meet with a steady sale.

Indian guano.—This variety of guano has not yet, so far as I am aware, been imported in quantity, but a sample was sent to the Laboratory some time since for analysis. It is a dark brown uniform powder, extremely bulky and light. When carefully examined, minute crystals are found in it in considerable quantity. The exact locality in which it is found has not been stated to me, but from various circumstances I have come to the conclusion that it must have been found in a cave, and that it consists of the dung of bats. It had the following composition:—

Water,	23.62
Organic matter and ammoniacal salts,	60.05
Phosphates,	7.18
Carbonate of lime,	2.79
Alkaline salts,	5.58
Sand,	0.78
	100.00
Ammonia,	10.27

This guano, it will be seen, approaches nearer to the requirements of agriculture than any of the recent importations, for it is an *ammoniacal* guano; and though greatly inferior to Peruvian, would doubtless prove a useful addition to those at present imported. The proportion of phosphates is remarkably low, but the ammonia gives it a considerable value; and estimating the latter at 6d. per lb., the sample must be worth about £6, 6s. per ton, at which price it might no doubt be profitably imported.

Several other new varieties of guano have recently been discovered, but none of these have become articles of commerce in this country, although likely to do so at no distant date; but as they have not yet come under my hands, I am unable to give any idea of their value. Of those now examined it is obvious that the last two are of considerable value, but still unequal to Peruvian, so that the great problem of obtaining a cheap and abundant supply of an ammoniacal guano is still to be solved; and it is a matter of great moment that the importance of its discovery should be kept prominently before the public.

While on the subject of guanos, it may be well to give an analysis of a variety sold under the name of Upper Peruvian, by which incautious purchasers are frequently misled. They are apt to imagine that it is merely a variety of Peruvian, and of equal value to the true Peruvian; indeed, the sample analysed had actually been offered for sale as being equal to the best imported, with how much justice the following analysis shows:—

Water,	10.54
Organic matter and ammoniacal salts,	21.68
Phosphates,	46.20
Alkaline salts,	18.31
Sand,	3.27
	100.00
Ammonia,	4.18
Phosphoric acid in alkaline salts, / Equal to 5.63 phosphate of lime,	2.60

Calculated in the ordinary manner, the value of this guano would not exceed £6 or £6, 10s. per ton, or, even allowing for the increased price of guanos, certainly not above £7; yet it was offered for sale at nearly the price of the best Peruvian.

That this and similar guanos find purchasers is certain; and it is astonishing that, at this time, when the comparative values of different guanos have been so frequently and prominently brought under the notice of the farmers, persons should be found ready to purchase inferior guanos at prices ridiculously above their value. The amount of absolute loss annually entailed upon the agricultural public in this way would be a curious matter of calculation. Experience has shown me that the price at which inferior guanos are sold may be taken in the average at fully £1, 10s. per ton above their true value, as estimated from the quantity of phosphates and ammonia. The quantity of such guanos imported varies very greatly in different years; but if we estimate it at 100,000 tons, we see that in this way an annual loss of £150,000 is entailed upon the farmer, and this is entirely independent of adulteration. When we recollect that this loss falls chiefly upon the smaller and least intelligent farmers—in fact, on these least able to bear it—it becomes a matter of great regret that the law does not supply some summary method of punishing the venders of adulterated articles. As far as inferior guanos, however, are concerned, the buyer must depend entirely on his own vigilance, and ought to ascertain the value of the article before concluding his purchase.

WHAT IS TO BE CONSIDERED AS THE STANDARD COMPOSITION OF SUPERPHOSPHATE OF LIME?

Nothing can possibly be more unsatisfactory than the want of a definite standard by means of which a substance is to be sold; and

in no case are greater inconvenience and loss entailed by it than in that of superphosphate of lime. When a manure is a definite chemical compound—such as nitrate of soda, or sulphate of ammonia—the obvious standard is the pure substance; and a price being fixed at which it is sold, that of the commercial article is regulated by the proportion of the pure salt it contains, each per cent of impurity simply deducting one hundredth from the value of the sample. Even with Peruvian guano, a substance of natural origin, and presenting a reasonable degree of uniformity, it is easy to obtain a standard from which good samples do not materially deviate, and which serves as an indication of what we are entitled to expect in a genuine guano. But it is quite different with a manufactured manure, in which the processes and proportions of the materials employed vary exceedingly, and where each maker may assert that his principle of manufacture is the best. The matter has been still farther complicated by the extension of the term superphosphate, which, when first introduced, was synonymous with dissolved bones, and meant a substance obtained by treating bones with sulphuric acid in such a way that a large proportion of their phosphate of lime was converted into another compound called biphosphate of lime, which is soluble in water. It was to the presence of this substance that the value of superphosphate was entirely attributed by the manufacturers, and hence they began to seek for cheaper sources of phosphate of lime; and the spent charcoal of the sugar-refiners, the coprolites which occur so abundantly in the newer tertiary formations, and, lastly, the apatite found in New Jersey, Norway, and other places, have been introduced to replace, in whole or in part, the bones formerly employed; and the products from all these substances have been indiscriminately called superphosphate: or if bones, in however small proportions, be used, the more popular name of dissolved bones, or bone manure, is not unfrequently employed.

The propriety of applying the name of superphosphate to all these substances cannot be disputed, in so far as they all contain, or ought to contain it; but it seriously complicates the commercial question, because the value of the product varies very materially, according to the raw material from which it is manufactured. This becomes at once obvious, if we bear in mind that bones in their natural state contain, in addition to their phosphate of lime, a large quantity (in round numbers, forty per cent) of animal matter rich in nitrogen, and that this animal matter is capable of yielding ammonia to the extent of about six per cent of the weight of the bones, so that very nearly half their value is due to the ammonia which they yield; and as the whole of the nitrogen remains in the superphosphate made from bones, it is manifest that we must take it into account when estimating the value of that manure. The spent animal charcoal of the sugar-refiners, as well as the purely mineral

phosphates, contain little or no nitrogen, and consequently they, and the superphosphates produced from them, are dependent for their value solely on the quantity of phosphates they contain. It may be alleged that the farmer purchases superphosphate as a source of phosphoric acid, and that he is entitled to neglect the ammonia, and look solely to the phosphates, and that he can be more cheaply supplied from coprolites or apalite than from any other source. But both these opinions are extremely questionable. In northern climates, at least, no manure which does not yield ammonia, or contain it ready formed, suits the requirements of our advanced agriculture, and, considering the high price of ammonia, the presence of even a very small quantity adds appreciably to the value of every manure. Nor is it the case that coprolites are a cheaper source of superphosphate, for they contain a large quantity of carbonate of lime, and consequently require for their solution a very much larger quantity of sulphuric acid.

In attempting to give a reply to the question with which we have set out, it will be necessary for me to give the results of analyses of different kinds of superphosphates; and before doing so, it may be well to explain the way in which the results are stated, particularly as regards the soluble phosphates. I have already mentioned, that in a superphosphate, part of the phosphate of lime is converted into the biphosphate by the action of the sulphuric acid, but in the analyses the quantity of the latter is not given, but the phosphates are divided into two portions, called soluble and insoluble phosphates. The mode in which this is to be understood, will be best rendered intelligible by an individual example. Thus, on the first of the subjoined analyses, we find 15.08 per cent of soluble, and 18.01 of insoluble phosphates; the sum of these, 33.09, expresses the quantity of phosphates existing in the manure previous to the addition of sulphuric acid, and the soluble phosphates are the quantity of *common phosphate of lime which is converted into biphosphate* by the sulphuric acid. This conversion is effected by the sulphuric acid, of which the proportion is given lower down in the analysis; and the sulphate of lime which also appears, indicates the quantity of lime which has existed as carbonate in the original substance, or which has been deliberately added for the purpose of drying up and giving bulk to the product. It is to be observed, then, that the soluble phosphates actually exist as biphosphate, although not so represented in the analysis; and though it would be more correct, in a scientific point of view, to give the proportion of biphosphate, yet the course I have employed has advantages for practical purposes, as it shows the mode in which the manure has been manufactured. The proportion of sand and of alkaline salts requires no comment.

The first two analyses are examples of superphosphate apparent-

ly made entirely from bones, and in which the proportion of soluble phosphates is large. In the one, a small quantity of gypsum, and in the other of alkaline salts, has been added, apparently for the purpose of drying the product.

	I.	II.
Water,	10.70	17.50
Organic matter,	12.74	15.63
Soluble phosphates,	15.08	13.08
Insoluble phosphates,	18.01	24.65
Sulphate of lime,	2.22	15.87
Sulphuric acid,	18.39	6.23
Alkaline salts,	13.06	4.63
Sand,	9.80	2.41
	100.00	100.00
Ammonia,	2.07	2.35

In both these we have examples of superphosphate of high quality, containing a large quantity of soluble phosphates, and a fair proportion of ammonia; and the importance of the latter becomes obvious, when we bear in mind that it adds £1, 2s. per ton to the value of the first, and £1, 5s. 6d. to that of the second sample.

The following are illustrations of superphosphates also from bones, but of lower quality than the preceding:—

	III.	IV.	V.
Water,	13.60	18.26	17.22
Organic matter,	24.90	11.95	14.83
Soluble phosphates,	8.71	7.06	4.50
Insoluble phosphates,	29.14	31.27	31.35
Sulphate of lime,	10.76	11.93	18.74
Sulphuric acid,	7.49	4.93	4.43
Alkaline salts,	1.82	11.18	1.20
Sand,	3.58	3.42	7.73
	100.00	100.00	100.00
Ammonia,	3.13	3.24	3.25

In these superphosphates the quantity of sulphuric acid employed has been deficient, and hence, though the total quantity of phosphates is as large as in the previous ones, a much smaller proportion is soluble; and as we shall afterwards more particularly point out, the value of the superphosphate is diminished. The quantity of ammonia, however, is large, and forms an item of some importance in estimating their value.

From these we turn to another variety, apparently made from a mixture of bones and coprolites, in which the ammonia little exceeds one per cent; the quantity of phosphates is rather lower, and of sulphate of lime higher than in those from bones alone.

	VI.	VII.	VIII.
Water,	17.98	24.33	13.84
Organic matter,	17.29	10.60	7.95
Soluble phosphates,	21.22	14.38	14.18

Insoluble phosphates,	3.41	14.36	7.44
Sulphate of lime,	20.82	16.00	21.71
Sulphuric acid,	5.19	6.48	19.62
Alkaline salts,	6.13	3.98	3.92
Sand,	7.96	9.87	11.34
	100.00	100.00	100.00
Ammonia,	1.66	1.03	0.93

	IX.	X.	XI.
Water,	32.39	16.10	21.04
Organic matter,	8.63	10.53	12.42
Soluble phosphates,	12.97	10.62	10.16
Insoluble phosphates,	16.12	10.48	9.58
Sulphate of lime,	18.54	3.92	33.90
Sulphuric acid,	6.10	23.89	3.94
Alkaline salts,	3.32	19.55	2.46
Sand,	1.93	4.81	6.50
	100.00	100.00	100.00
Ammonia,	0.79	0.80	1.10

And, finally, we have examples of superphosphates made entirely from coprolites or other mineral phosphates, distinguished by a small proportion of organic matter, and abundance of sulphate of lime. In one only, however, is ammonia entirely absent, the others contain small quantities, though none of them, except the last, in sufficient quantity to be of value.

	XII.	XIII.	XIV.	XV.	XVI.
Water,	8.43	18.20	23.77	23.78	14.00
Organic matter,	0.00	2.83	3.00	1.70	0.63
Soluble phosphates,	15.37	14.04	12.19	10.24	13.90
Insoluble phosphates,	15.07	6.15	7.77	7.95	23.98
Sulphate of lime,	36.03	36.88	36.23	38.56	31.57
Sulphuric acid,	11.24	11.51	8.44	4.15	8.24
Alkaline salts,	1.60	3.17	0.01	7.56	1.06
Sand,	12.26	7.22	8.59	6.06	6.62
	100.00	100.00	100.00	100.00	100.00
Ammonia,	0.00	0.56	0.49	0.45	0.60

It would be easy to multiply analyses of the different sorts of superphosphate, but those given are sufficient to show how greatly different samples, all made with the desire of supplying a reasonably good article, vary in composition and value. Yet it is probable that no great difference in price will exist among the greater number of them. Those made entirely from bones, and coming from manufacturers of high standing, are generally dearer; but no commercial distinction is drawn between the others, a fixed market price generally being charged, altogether independently of composition. Yet a moment's inspection suffices to show that the differences in value are exceedingly great.

Some difficulty exists in forming a satisfactory estimate of the

value of a superphosphate from its composition, owing to there being no fixed value to attach to the soluble phosphates, except that calculated from the manure itself. But, taking as a starting-point the samples produced from bones, we may arrive at some definite idea in the following manner: I assume ammonia at 6d. pér pound, or 11s. for every per cent, and *insoluble* phosphates at ¾d. per pound, or, in round numbers, 1s. 6d. for each per cent. Now, such superphosphates as Nos. 1 and 2 are sold at about £8 per ton; and if we calculate the value of the ammonia and insoluble phosphates, and deduct this from £8, we have the value of the soluble phosphates. Thus we have for Nos. 1 and 2—

	No. 1.	No. 2.
Value of ammonia per ton, . .	£1 2 0	£1 17 0
Value of insoluble phosphate, . .	1 7 0	1 6 0
	£2 9 0	£3 3 0
Deducting this from £8, leaves for the value of the soluble phosphates, . .	£5 11 0	£4 17 0

And dividing these sums by 15 and 13, the respective per-centages of soluble phosphates, we find it in both cases to give a value of almost exactly 7s. 6d. for each per cent of these substances. The better class of the other superphosphates give a similar, though somewhat higher value for the soluble phosphates, except No. 6, which, if sold at £7, would give a lower value; but as I do not know its price, we must not allow it to influence the calculation. It is probable that we shall not err greatly by assuming 7s. per cent as the value of soluble phosphates.

Now, if we apply this mode of calculation, we see that the values differ excessively. Thus, No. 3 gives—

29 per cent insoluble phosphates at 1s. 6d. per cent, .	£2 3 6
8.71 per cent soluble phosphates, at 7s. per cent, . .	3 1 0
3.13 per cent ammonia, at 11s. per cent, . . .	1 14 6
Value per ton, . . .	£6 19 0

And in the same manner, No. 5 is worth £5, 13s.; No. 7 ought to cost £6, 10s.; No. 15, £4, 8s., and so on.

No. 6, calculated upon this principle, shows a higher value than any of the other samples, by virtue of its large proportion of soluble phosphates; its calculation giving—

21 per cent soluble phosphates at 7s., . . .	£7 7 0
3 per cent insoluble phosphates at 1s. 6d., . .	0 4 6
1.6 per cent ammonia, at 11s., ...	0 17 0
Value per ton, . . .	£8 8 6

Now, if we take into consideration the preceding calculations,

and the composition of the commercial samples of superphosphate, it appears to me that we may assume a standard to which all well manufactured samples should attain. It would appear that a good superphosphate should contain 15 per cent of soluble phosphates, and 15 insoluble; and if made from bones, in addition to these, not less than 2 per cent of ammonia. A superphosphate made from coprolites, and containing these proportions of phosphates, should be sold for £7, and from bones at £8. According to my experience, the samples coming from the best manufacturers have about this composition; but the farmer would do well to remember that a large proportion of soluble phosphates adds most materially to the value, as is seen in the analysis No. 6. It is very desirable that this fact should be distinctly brought before the manufacturers, who would find it decidedly to their advantage to aim at producing a manure containing a large proportion of soluble phosphates, which, they would find, repays them better than producing the inferior qualities, particularly if got from coprolites, because a considerable proportion of the acid is consumed in neutralising the carbonate of lime. Thus, suppose a sample of coprolite to contain 20 per cent of carbonate of lime, and the manufacturer to add to it 30 per cent of sulphuric acid, 25 of the acid would be consumed in converting the carbonate into sulphate of lime, and only 5 per cent would remain over to convert the insoluble into soluble phosphates; but if he added 35 per cent of acid, 10 per cent would remain, and he would then produce a superphosphate with twice the quantity of soluble phosphates contained in the former.

These observations I have thought it well to bring before the farmer, as I know that large quantities of very inferior superphosphates go into the market. It is not my intention to refer particularly to these articles here; it will suffice to say that many tons, containing 2 or 3 per cent of soluble phosphates, are yearly disposed of in different parts of Scotland.

ANALYSES OF TWO SAMPLES OF SULPHATE OF POTASH.

We have frequently had occasion to call attention in the pages of the Transactions to the difficulty which exists in obtaining chemical manures in a state of purity. The substances usually sold for the purpose are, for the most part, the refuse of different manufacturing operations, and are dignified with the name of the most valuable substance they contain, even although the quantity may be but a small fraction of the whole, while a price generally greatly above their intrinsic value is charged for them. The two analyses which are now given, curiously illustrate this fact:—

No. I.

Common salt,	21.45
Sulphate of soda,	37.48
Carbonate of soda,	16.98
Sulphate of potash,	8.22
Carbonate of lime,	0.32
Carbonate of magnesia,	0.17
Sand,	0.44
Water,	14.11
	99.17
Potash,	4.44

No. II.

Common salt,	67.44
Carbonate of soda,	2.51
Carbonate of potash,	3.98
Sulphate of potash,	19.44
Carbonate of lime,	0.26
Carbonate of magnesia,	0.31
Sand,	0.74
Water,	5.24
	99.92
Potash,	13.20

The absurdity of calling such samples sulphate of potash is manifest. In fact, if the principle of calling a substance by the name of its largest constituent be adopted, the first sample would be called sulphate of soda, and the second common salt.

Both are doubtless the refuse of some manufacturing operation, although I have no information of the source from which they were obtained. Their analysis is an important lesson to agricultural experimenters, for it unfortunately happens that many experiments have been made, which have proved quite valueless from the want of certainty as to the substances used. Theoretically, we have reason to believe that potash should be a valuable manure, and yet we cannot conclude either for or against it from the experiments already made. It is for this reason that an additional set is being made this season by a variety of gentlemen connected with the Highland Society. And in order to insure the results being fully comparable, muriate of potash, in a state of nearly chemical purity, has been employed, although it is an expensive substance; but it is intended merely to draw conclusions from these experiments, and should they show that potash is valuable, some other forms of combination may be employed. In fact, impure muriate of potash is much cheaper than that brought up to the highest degree of purity; that is to say, a substance containing only fifty per cent of muriate of potash sells at much less than half the price of the pure salt, so that, except for exact experiments, the latter would be preferable. Both muriate and sulphate of potash are commercial articles, having a fixed market price, and, as with all other substances, they are cheapest when dearest, low price being the surest indication of adulteration, or at least of inferiority.

AGRICULTURAL STATISTICS (SCOTLAND), 1854.

SUPPLEMENTARY REPORT BY THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

SIR,—I am now enabled to close the inquiry into the Agricultural Statistics of Scotland for 1854, by submitting to my Lords of the Committee of Privy Council for Trade, Returns, applicable to that class of agricultural occupants not included in my Report of the 23d of January.

It will be in the recollection of my Lords that it was considered inexpedient to ask information directly from the smaller tenants, from an apprehension that many of them would be unable to comprehend the inquiries made, and to complete the schedules served on them, and that it was resolved to obtain, through other channels, general returns in reference to their holdings. In determining the point where the issue of schedules should cease, it was found necessary to draw a distinction between the Lowland and the Highland districts. In the former, it was believed that schedules might safely be sent to all persons paying a rent of £10 and upwards; in the latter, it was represented that it would be unavailing to seek direct information from parties rented at less than £20.

The Tables appended embrace returns for 16,144 occupants under £10 in twenty-six counties, and for 26,085 under £20 in seven counties. There is thus apparently a county in excess, which arises from Bute and Arran having been divided, the one island being placed in the £10, and the other in the £20 category.

I should farther mention that, in Caithness, schedules were originally served on all occupants at £10 and upwards, but that, owing to the nature of its crofter population, it has been found advisable to alter this arrangement, and to apply the £20 rule. The present returns, therefore, repeat a certain extent of acreage, and amount of stock, included in my former Report; and, in order to prevent an over-estimate of the statistics of Caithness, there must be deducted from the Returns in that Report 8089 acres, and 6202 head of stock.

Owing to the number of small occupants to be dealt with—almost equalling that of the Tenantry of the country—and to the difficulty of finding the proper parties from whom to obtain information, the preparation of the Returns now submitted has involved a greater amount of time and labour than was anti-

cipated. It is just, however, to record that, under this section of the inquiry, I experienced the same co-operation, and received the same assistance, as I already have had occasion to report upon so favourably to my Lords; and I cannot but avail myself of this opportunity to state the obligations under which the public lies, not only to the farmers officially engaged in conducting the inquiry, but to the many proprietors, agents, factors of estates, inspectors of poor, and others through whose assistance the Returns have been compiled.

Every precaution has been taken to make the Returns as accurate as possible. They are necessarily of a more general character than those made by schedule, and in some respects they are rather approximative to, than strictly statements of the fact. In most cases the exact number of occupiers could be correctly ascertained, and has been accurately returned; stock also was susceptible of a strict enumeration; acreage, on the other hand, had frequently to be estimated. In Shetland, particularly, the returns of acreage must be taken with considerable allowance. I had the advantage of obtaining from most of these islands very intelligent returns, carefully prepared by the parochial schoolmasters, and embracing valuable information; but, as the land is there almost exclusively held under the "*merk*," a Norwegian measure of extent of fluctuating character, it was frequently difficult to arrive at correct data for determining acreage.

I have already informed my Lords that it is not proposed in the mean time to repeat these Returns. The variations incidental to such small holdings, and the extent to which they could affect the general results as regards the stock and crop of the country at large, are too immaterial to necessitate the labour and expense which an annual repetition of this section of the inquiry would involve.

I have the honour to be,

SIR,

Your most obedient Servant,

J^N. HALL MAXWELL,

Secretary.

JAMES BOOTH, Esq.,

Principal Secretary of the Board of Trade.

I.—GENERAL RETURN.

I.—GENERAL RETURN OF HOLDINGS RENTED AT LESS THAN £10.

Counties.	No. of Occupants.	No. of Arable Acres.	Stock.				
			Cattle.	Horses.	Sheep.	Swine.	Total.
1. Aberdeen, .	4,607	31,213	9,672	1,186	1,732	1,063	13,653
2. Ayr, . .	433	910	493	63	69	126	751
3. Banff, . .	2,575	13,594	3,501	830	1,106	867	6,304
4. Berwick, .	362	878	280	48	926	169	1,423
5. Bute, . .	144	486	196	25	165	49	435
6. Clackmannan,	46	127	71	8	...	57	136
7. Dumbarton, .	167	363	164	34	6	146	350
8. Dumfries, .	717	2,205	886	137	174	806	2,003
9. Edinburgh, .	99	414	120	34	20	21	195
10. Elgin, . .	613	4,336	1,301	368	1,687	241	3,597
11. Fife, . .	648	1,765	637	158	7	415	1,217
12. Forfar, . .	858	5,843	1,948	183	510	682	3,323
13. Haddington, .	76	94	60	47	63	52	222
14. Kincardine, .	751	3,625	1,332	149	33	532	2,046
15. Kinross, .	42	78	36	7	...	35	78
16. Kirkcudbright,	198	738	372	45	82	678	1,177
17. Lanark, .	338	1,131	431	37	...	104	572
18. Linlithgow, .	34	107	45	6	...	15	66
19. Nairn, . .	198	1,656	467	192	313	141	1,113
20. Peebles, .	48	83	36	6	...	28	70
21. Perth, . .	2,021	4,953	2,278	354	677	1,438	4,747
22. Renfrew, .	50	68	32	11	...	20	63
23. Roxburgh, .	482	883	567	182	122	675	1,546
24. Selkirk, .	65	109	51	26	100	30	207
25. Stirling, .	326	754	299	41	26	119	485
26. Wigtown, .	246	1,319	423	96	53	409	981
	16,144	77,732	25,698	4,273	7,871	8,918	46,760

II.—GENERAL RETURN OF HOLDINGS RENTED AT LESS THAN £20.

Counties.	No. of Occupants.	No. of Arable Acres.	Stock.				
			Cattle.	Horses.	Sheep.	Swine.	Total.
1. Argyll, . .	2,845	19,876	10,914	1,750	12,831	1,395	26,890
2. Island of Arran,	393	6,211	1,880	519	750	393	3,542
3. Caithness, .	2,964	24,827	10,030	3,862	4,710	3,257	21,859
4. Inverness, .	4,554	27,887	14,932	3,316	34,796	664	53,708
5. Orkney & Zetland,	6,541	44,961	36,782	9,219	38,758	8,915	93,674
6. Ross & Cromarty,	6,131	25,515	20,391	4,061	35,760	2,021	62,233
7. Sutherland, .	2,657	11,161	8,842	2,008	13,956	836	25,642
	26,085	160,438	103,771	24,735	141,561	17,481	287,548

ABSTRACT.

	No. of Occupants.	No. of Arable Acres.	Stock.				
			Cattle.	Horses.	Sheep.	Swine.	Total.
1. Holdings in 26 counties rented at less than £10, .	16,144	77,732	25,698	4,273	7,871	8,918	46,760
2. Holdings in 7 counties rented at less than £20, .	26,085	160,438	103,771	24,735	141,561	17,481	287,548
Total, .	42,229	238,170	129,469	29,008	149,432	26,399	334,308

GENERAL PRINCIPLES OF RECLAIMING LAND.

By Mr JOHN LOCKHART MORTON, Civil and Agricultural Engineer, Edinburgh.

[Premium—The Gold Medal.]

THE importance of increasing the agricultural resources of the United Kingdom is universally admitted, for it is obvious from the turn of events that we cannot always depend on supplies of grain from foreign countries. If the produce of this country were equal to the consumpt, the amount of money retained in it, directly and indirectly, would probably exceed the calculations even of the most sanguine economists. With the assistance of agricultural and other statistics, it might be possible to demonstrate in a very striking manner the intimate connection which exists between abundant crops and national prosperity; but my object in this paper is rather to point out the means by which systematic agricultural improvements may be made remunerative to landed proprietors and farmers, than to treat of their bearing on the state of the country at large. While an improved and higher system of farming than is general at present, is certain, under good management, to prove profitable to those engaged in such undertakings, it is in the conversion of waste and hitherto uncultivated moorlands that the largest profit is to be expected by the landlord. The principal drawback in the reclaiming of waste land has usually been the heavy outlay required, and the consequent unlikelihood of a sufficient return being received on expended capital. There are, no doubt, many naturally good soils lying in an unprofitable state that cannot, by reason of circumstances over which the owner has no control, be reclaimed with advantage. The climate may be bad, or the altitude so great, as to render improving operations injudicious. But there are other cases where, even under very unfavourable circumstances, both in respect of soil and climate, improvements can be undertaken with a reasonable prospect of remunerative success. It is too much, however, in every case to expect returns of 6 or 8 per cent on the outlay connected with improving operations, when a rental of 3 or 3½ per cent would be thought a fair interest on capital expended in purchasing land. After deducting the purchase value of the ground in its original state, the improvements should be considered perfectly successful if they give a return equal to that which might naturally be expected from ordinary well secured investments in land. There can be no surer investment than that which properly conducted improvements confer; and while in some of the worst districts of the country the returns are likely to be as low as already indicated, there are numerous instances in which from 6 to 9 per cent may be secured on expended capital. To those who have arable land let on lease in the vicinity of waste ground, another induce-

ment to begin improving operations naturally presents itself. If a farm adjoining a moor is to be let on lease, no one will give the same rent for it that he would do were it bounded by highly-cultivated ground. Such farms have generally bad names, more in consequence of contiguous moorlands than anything bad in themselves; and hence the profit of reclaiming unsightly moors is not confined to them, but extends to all the surrounding arable land. A proprietor with two thousand acres of good ground, and five hundred acres covered with heather, gorse, broom, or at best mere aquatic and coarse innutritious grasses, must often feel that the bad name which, in public estimation, is very justly attached to the latter, is liable also to be assigned to the former. Indeed, the general character of the property may be as much lowered by its having five hundred acres of bad land, as if it had three times that extent. The increased salubrity of the district which follows the reclaiming of wet uncultivated land, should also operate as an inducement to proprietors to engage in improving undertakings. In the fen districts of England, ague and other epidemics were always prevalent till drainage was effected; and in many parts of Scotland and Ireland, healthfulness has been greatly promoted by the improvement of waste land. In some districts where there are extensive unimproved peat-mosses, cholera prevailed in the summer of 1854 to a much greater extent than in places where no such unhealthy influence existed. If the moss had been so completely covered with water as to present to the sun's rays little else than the bosom of a lake, the evil would have been greatly mitigated; but from the nature of the weather in the early part of the season, the surface was partially dried, and the evaporating process, in taking up the gases of decaying vegetable matter, spread them over a large extent of surrounding country, to produce disease and death. In many cases, arable farms in the vicinity of bogs become earlier and more productive by the latter being drained. One farm, well known to the writer, used always to have many acres of oats on the side next a flow-moss frosted in a green state; but on a plantation being formed on that side, and a considerable extent of the peat thoroughly drained, the frosting entirely ceased. From these and many other evidences that might easily be adduced, it appears conclusive that the reclaiming of waste land, both in its cumulative and individual effects, is deserving of very careful consideration. Wherever improvements can be undertaken with any reasonable prospect of success, it almost becomes the public and private duty of a proprietor to carry them out promptly and judiciously.

In considering the systems of reclaiming waste land which can be followed with the greatest possible advantage, I purpose to divide this paper into various primary sections, under each of which there will be subdivisions of the subject treated of.

I. *Waste land in the worst sense.*—Under this heading, the

reclaiming of peat-mosses may occupy some attention, but it is altogether foreign to the subject under consideration to enter into the origin or growth of such deposits. It is sufficient for its treatment to know that extensive mosses do exist in various districts of the country, and that, could they by any possibility be reclaimed to yield a remunerative return on the outlay, a great benefit would be conferred on their owners and the community at large. There are no doubt many peat-bogs which cannot be reclaimed, except at an enormous cost, but certainly they are not so numerous as is generally believed. The most improvable flow-mosses are those that sward over on the surface, however wet it may be. Vegetation will probably be of the coarsest description, consisting only of species of heather (*Erica*), rushes (*Juncus*), and aquatic grasses (*Carex*;) still it affords sufficient evidence of the naturally improvable qualities of the peat, and gives the best guarantee of success which the improver could desire. Mosses of this kind generally consist of fibrous inert vegetable matter, which, if once fermented, will produce excellent crops. In few instances is it imperative that bogs of this nature should be coated with clay or gravel, as they have generally sufficient stamina in themselves; but no doubt, where such coatings can be given at a moderate expense, the productive power of the soil will be greatly increased by the application. The mosses that are commonly the least improvable are those the surface of which consists in a great measure of heather blooms and the remains of the poorer sorts of heath plants. Where possible even to promote the decomposition of this worthless material, the results are generally far from being of a satisfactory nature. It appears to be so poor in the ingredients which constitute the food of cultivated plants as to afford them almost no nourishment; and hence, decompose it as completely as one may, the improved effects are usually of a very transitory nature. The only way in which peaty matter of this description can be profitably improved, is to give heavy applications of clay, gravel, or earth. By this means consistency and strength are given to the soil, and it is kept from being scorched or blown away in summer weather. It is no uncommon thing for mosses of this nature to be overdrained by systems of drainage which, in other cases, would barely be sufficient to remove the stagnant antiseptic moisture. A third variety of peat, though it can scarcely be called flow-moss, consists of floated material containing more or less earthy matter. This has been termed lacustrine bog, and constitutes by far the most improvable mossy soil which is known. The fens of Cambridgeshire, Lincolnshire, and Norfolk, are principally composed of this deposit. It is more easily decomposed than any of the other varieties of moss, and when properly improved becomes very productive land. On the outskirts of extensive peat-bogs there are generally stripes, of

greater or less extent, having a soil of this description, which is much prized by farmers for the making up of compost-heaps. In reclaiming peat-mosses, much money in some cases is thrown away by the actual nature of the surface being misunderstood; and in others, the means adopted to effect the improvement are but very imperfectly calculated to secure the desired end. In treating of the various modes of reclaiming flow-mosses and other peaty accumulations, the first step which the improver requires to take may here be noticed.

Drainage of flow-mosses.—There are few reclaiming operations so liable to deceive the improver as that of moss drainage. He may put in drains 5 or 6 feet deep, and imagine the drainage perfect, but in a few years he is likely to have the mortification to find that his 6-feet drains have become 4-feet ones. The subsidence of fibrous moss is much greater on being drained than persons unacquainted with it will be inclined to believe. Sometimes open drains, formed 4 feet deep in the beginning of summer, will be found in autumn only about 3 feet in depth; and if in the following spring the drains are deepened 3 or 4 feet more, the surface will again subside 6 or 8 inches. The judicious improver will therefore never think of putting in covered drains the full depth at once. It is invariably safer to lay off open drains from 40 to 60 feet apart, according to the nature of the moss, and cut them 3 to 4 feet deep, with a good slope on the sides. Of course they should invariably be made to run in the direction of the greatest natural fall, and no reasonable expense should be spared in the formation of outfalls and main drains. The width of the drains at the bottom should not exceed 15 inches, and the material dug out ought to be thrown as well back from the edges as possible. The cost of forming such preliminary drains, say 60 feet apart, will be something like the following by the imperial acre:—

Cutting 44 rods, of 5½ yards, 4 feet deep, broken 7 feet wide on surface, and finished 15 inches broad at bottom, neatly cleaned out, at 8d., ...	£1	9	4
Extra cutting of main drains, and various contingencies, say	0	5	8
	£1	15	0

In ordinary circumstances, this may be taken as the first outlay in reclaiming flow-moss, on what appears to be the best principle yet discovered. If the open drains are formed as early in the season as the weather will admit, the summer's drought will be sufficient to remove the greater portion of the stagnant water, and prepare the surface for the works to be undertaken in the second year. In some cases where the extreme wetness of the bog has prevented the drains from being made deep enough, it will be necessary the next summer to deepen them 2 or 3 feet, and leave

them open for a few months to take off the water, but very frequently the drains may be covered the second summer.

The way in which this work should be undertaken is easily described. Where the moss is of a very tenacious nature, 60 feet between the drains may be rather much, but generally it will serve to give thorough drainage. There is often considerable danger, as previously remarked, of rendering some kinds of peat soils too dry; and certainly if the drains are fully 6 feet in depth, they will "draw" a great distance. Suppose the 4-feet open drains have been reduced to a depth of 3 feet, and that, after the covered drains are put in, a further subsidence of about 8 inches may be calculated upon, it follows, that to have the drains at no time less than 6 feet deep, it will be necessary to cut out 3 feet 8 inches below the bottom of the open drains. As nearly all mosses are flat, and liable to have sluggish currents, it is imperative that the greatest care should be taken of the levels in draining. For this purpose none but the most experienced and most trustworthy workmen should be employed; and to prevent temptation, the bottomers at least should rather be paid by days' wages than by piece-work.

In numerous instances it is impossible to go through the peat in forming the drains; but even with a very soft bottom there is little difficulty in keeping the levels properly, if due care is taken on the part of the workmen. Wherever the bottom is so very soft as to run together when the deep drains are being formed, there is rarely any other alternative, as already mentioned, than open draining for another summer till the excess water is drawn off and the moss becomes tolerably firm. If the sides of the drains will stand cutting, it will be advisable to lay the tiles immediately behind the workmen, taking particular care, however, in stopping work, to have a piece of slate or stone placed accurately on the vent of the last laid pipe, to prevent the ingress of mud. It has generally been thought indispensable, in draining soft-bottomed land, to use tile-and-sole in preference to circular pipes. From an experiment made in the spring of 1850, I found it altogether a mistake to suppose that circular pipes would sink even in flow-moss. In a peat-bog 12 to 14 feet in depth, I had several drains formed about 5 feet deep. The bottoms of the drains were so soft, and the currents of water so much obstructed by flocculent matter floating about, that it was with difficulty the pipes could be got laid without being at once put completely out of sight. With a little care in the laying, they were put in ultimately in a tolerably satisfactory manner; and though some mud did get inside, it was found that the constant run of water soon cleared them completely. The diameters of the pipes were respectively 3 and 2 inches, laid without collars. On being put into the drain, a covering of broken peat was packed carefully on the top of the pipes,

and pretty firmly pressed down with the foot, the remainder of the excavated material being put in with the spade in layers of 8 or 10 inches, and left with as few interstices as possible. To ascertain whether the pipes would sink in this moss, one of the wettest parts was selected, and a straight-edge, having a vertical staff fixed at each end, being laid on the top of the tiles, the material above was filled in similar to the other drains. The straight-edge was about 10 feet long, and the tops of the vertical staves were placed in line with those of two sight or level posts, fixed at short distances, in such a way as to render the sinking of the former, even the sixteenth of an inch, quite perceptible. After a period of four and a half years, it has been found that the tiles have not sunk *anything*, and now both 2 and 3 inch pipes are running more beautifully than in the day in which they were put in. This test was, no doubt, only calculated to prove the sinkage of the tiles over an extent of 10 feet, if there had been any; but by examination in various places, it has been found that not even in the case of single pipes has there been the slightest sinking in any part of the drains. The workmen, in laying the drains, were of course careful in seeing that each tile had as solid a bed as those adjoining it, and hence, if there did happen to be any subsidence, all the pipes would go down nearly an equal distance, and no damage would be done to the general efficiency of the drain. When the natural laws which come into operation before a properly covered pipe can sink are taken into consideration, it will be easily seen that there is no mystery about it. It is certain that if two layers of compact peat be placed one over the other, no portion of the under layer can take the position of any portion of the upper without a displacement occurring. A cubic inch of matter of any kind cannot be made to occupy the space sufficient merely for half a cubic inch, unless extraordinary pressure be applied. Now, in filling drains in flow-mosses, it is of the greatest importance to keep this theory in view, for if the covering next the tiles is closely and carefully packed, it is obvious that the matter underneath them cannot be displaced. Even in the very softest bottomed bogs this theory will hold good, as may be illustrated at any time by a little experiment with a dishful of mud. If a wooden plug be made to fit the mouth of the dish so closely as to prevent the escape of the contents, no amount of pressure will make the plug sink, the elasticity of the compressed water being sufficient to throw it back to its original position. This must always be the case also when the pipes in soft-bottomed ground are properly covered. The matter on which they rest will undoubtedly have a tendency, when pressure is applied, to spue up on both sides; but if the covering is well pressed down, this liability will be completely overcome, and the tiles will lie as securely as if placed on the most solid subsoil.

The tendency of circular pipes to sink being got over, it will be

obvious to every one that in other respects they are altogether superior to tiles and soles. With the contracted channel the current of water is so much strengthened that any sediment which may obtain a resting-place is carried off whenever a wet day occurs. Flat-bottomed tiles, in some kinds of mossy ground, are very liable to grow up in a few years, as any one having experience of them knows. In cases where wooden soles have been used, I have seen drains nearly choked up in two or three years by parasitic plants getting attached to the wood. By their alternate growth and decay a miniature peat-bog was formed in the interior of the tile, and, as an inevitable result, the drains were soon gorged up. It is only on some kinds of flow-mosses that this peculiarity exists, and wood may therefore be used with perfect safety where there is no such liability. After an experience of many years, Mr Hall Maxwell finds no tendency of this kind in the mosses he has improved, and therefore, with open tiles, he very justly considers wood superior to all other material for bottoming. With pipe-tiles there is no instance in which they can grow up, if properly laid, and in one respect the smaller the pipes are the better, if they are of sufficient size to carry off the water. In general, 2-inch pipes with collars will be found perfectly sufficient, except in very long drains, where, from the quantity of water at the lower ends, it may be necessary to use 3-inch pipes. When the pipes are being laid, it is not only indispensably requisite that the ends should be as closely jointed as possible, but wherever a hollow or uneven bottom occurs, a little *dried* peat should be put in to fill up the voids, and give an even resting-place for the pipe.

The culture of moss.—Suppose, then, that in reclaiming deep mosses the system of open draining recommended in a previous page has been adopted, and that the cutting of the open drains to a depth of fully 6 feet and laying them with tiles has also been followed, the subsequent cultivation will require to be taken into consideration. As a good deal of excavated peat will have been thoroughly dried, it is of great importance to keep as much of it on the surface as possible, and hence, in filling the drains, it will often be advisable to take sufficient material off the sides, to close up the whole to within 8 or 10 inches of the general surface-level. The dried peat, being well broken down and spread over the surface, may either be trenched or dug in as may seem advisable.

If lime is to be used—and there are indeed very few instances, in reclaiming moss, in which its use can well be dispensed with—the dried peat on the surface should be collected together in heaps of one or two carts, to be ready for mixing with it. When the surface is very soft, carts will not be available for taking the lime over it; but by means of several three-wheeled barrows running on lines of movable planking, the conveyance of the lime is a simple and not very expensive matter. To fit the peat for being

mixed with the hot lime-shells, it should be well broken down, and contain, if possible, no more moisture than will be sufficient to slack the lime. On a few barrow-loads of lime being laid down, a little moist peat should be thrown amongst it, and the surface must then be immediately covered over with twice as much of the dry moss as there is of lime. The lime, which may amount to 6 or even 10 tons per acre, according to the nature of the peat as well as the quality of the lime, will speedily absorb water, and produce steam and warmth, which will so raise the temperature of the surrounding peat as to give it more even than a blood-heat. After lying a week or two in this state, the heaps should be turned and the moss uniformly mixed with the lime. The outer surface of the heaps should then be covered with a few inches of peat, well pressed down, and in this state the compound may lie till used several weeks after. Lime has often been used in this way with extraordinary results, and theory bears out the assumption that it must be a good system for preparing the dried moss to act as a manure, by promoting its rapid fermentation, and liberating its fertilising ingredients. A compound of this kind, when applied to damp peaty soils, warms them, and changes their nature physically as well as chemically. If the covered drains have been completed by the month of June or July, and the lime applied, say by the beginning of August, no time should be lost in getting the surface turned over so as to have as much of the summer weather to act upon it as possible. The drier this operation is performed the better, especially with a view to promote the efficient action of the newly-applied lime. There are various ways of breaking up the surface, but in most cases where the plough cannot be used, digging will prove the cheapest and most satisfactory course to adopt. By trenching in the lime and dried peat lying on the surface, they are too deeply buried to serve any useful purpose the first year, while, by digging, the reverse is the case. Assuming the lime compound to be ready for spreading over the surface, and digging the mode of cultivation to be followed, the operations should proceed as under-mentioned.

Care having been taken to prevent the lime being drowned in wet weather, it may be applied at one time to whatever extent of surface it will be possible to dig over within a day or two. It is often a great disadvantage to allow the lime compound to lie exposed on the surface for any lengthened period. In wet seasons it is washed in such a way as to completely destroy its causticity and principal value in peaty soils; and in any case its exposure to the atmosphere converts it into a carbonate, and thereby renders it less valuable for the time being than it would otherwise be. The more powdery it is when applied the better, and the sooner it is dug in, also after being spread, the greater good it is likely to do. Though the digging does not require much skill on the

part of the workmen, except in keeping the red surface as level as possible, yet they must be very carefully looked after when at work. If the surface is covered with heather or other coarse plants, it will be indispensable to have a good wide burying furrow always ready for the roughest spits to be pitched into it; and in every case care must be taken to burn the herbage completely, which, if very rank, may require cutting to facilitate the labour. The deeper it can be dug the better, and in no case should the depth be less than from 8 to 10 inches. In the digging operation, the lime, with proper care, will be well mixed with the upturned material, and that which finds its way into the bottom of the furrow will easily be brought up by a future deep ploughing.

Where the inequalities of surface are great, such as in the case of moss "hags," or gulleys of greater or less depth, it is assumed that, to prevent the loss of lime, some labour in levelling will be undertaken before applying the compost, otherwise the waste must be considerable. If the sward is very tough, it will sometimes be found of advantage to use a turfing-spade before beginning to dig. The pared turf can be easily buried in the bottom of the spade furrow; and in most cases it will be advisable to lay the turf with the rough side up, as it both rots better in this position, and is more available as manure, than when dug down in the reverse way. As one piece is being dug another can be spread with the lime; and in this manner, if men are easily obtained, a large extent of surface may be dug before the termination of summer weather. It is always of importance that the workmen shovel out the loose matter in the bottom of the spade furrow, and throw it upon the top, as this affords an excellent covering for the seed in the following spring. After the digging operation has been completed, nothing more can be done till next seed-time, when an oat crop may be sown. As early in the spring as the weather will by any possibility permit, the sowing should be begun. In most cases, from 2½ to 3 hundredweights of Peruvian guano per imperial acre can be profitably harrowed in with the seed. The frost of the previous winter having acted with advantage on the surface, there will be no difficulty in obtaining a sufficient tilth to cover the seed; but care should be taken not to use harrows with too rank teeth, in case of tearing up the buried turf. Unless in very early districts, and on superior mosses, it is a mistake to sow anything but the earlier and lighter kinds of oats. Common early seed, Barbachlaw, Tam Finlay, or Black Tartarian oats, are perhaps the most suitable kinds to sow, and it will generally be found necessary to give from 4 to 5 bushels of seed per acre. The crop of the first year will rarely be a heavy one, and without guano it will generally be worth very little. After the first crop has been removed from the ground, a favourable opportunity will be presented to apply a coating of earth, clay, or gravel, if these

can be conveniently obtained. In cases where an application of this nature can be made before the rough surface is broken up by the digging operations, it is likely to have a beneficial effect on the first crop; but till the land has been levelled by cultivation, and consolidated by the continued effects of the drainage, it is only at an enormous expense that any considerable quantity of earthy matter can be laid on the surface. If the weather is not dry enough, immediately after the removal of the first crop from the ground, to admit of loaded carts going upon it, the frosts of the following winter will generally afford the requisite facilities for doing so. The quantity of consolidating material to be applied to the surface must depend on the facilities which exist for obtaining it; but, by a beneficent provision in nature, mosses are rarely without a supply of suitable earthy substances for improving them, near at hand. On the strongest peat-mosses 50 carts per acre will do much good; but for the weakest and least valuable kinds several hundred carts will often fail to give sufficient tenacity to the surface. In ordinary cases, however, 100 to 150 carts will pay, but much beyond this it will not be remunerative, unless the ingredients applied are very superior in their nature. Of course, where it is scarcely practicable to get substances suitable for laying on the moss except at a great outlay, they must be dispensed with; and if proper care has been taken to promote fermentation of the peaty matter, this will frequently be less disadvantageous, at least for green crops, than one is liable to suppose. After the earth has been applied, or whether it has been used or not, during the winter following the first crop no time should be lost in getting the plough set to work. The nature of this ploughing must depend on the crop which is to be grown the second year. If a green crop is wished, the ground should be turned over by a large fallow-plough, and get a strong furrow. With sufficient horse power at command it will be possible not only to bring up the turf dug down eighteen months previously, but to lay 2 or 3 inches of fresh matter on the top of it. Where the turf has been excessively tough, it is generally advisable to take a second oat crop before stirring it. With a similar dressing of guano to that of the previous year, and the decomposing influence of the lime formerly applied, the second year's crop is frequently in such cases much better than the first, and the ground can quite easily stand this course of cropping without any material disadvantage. In case of such a mode of cropping being determined on, it will be necessary only to give a very light furrow, as early in the winter after the earth has been applied as possible. Four to six inches deep in this case is sufficient, and in that way the old turf continues to lie undisturbed for another year. The third year the land should be under green crop, principally turnips of the yellow

or white sorts. To prepare for this crop, deep winter-ploughing is indispensable; and in the spring there will be a great deal to do for the grubbers and other turf-tormentors. Both farmyard and portable manures should be liberally applied in the drills, and in this case a fair crop may be justly expected. The succeeding crop will be oats nourished with guano, and the land may then be sown out to grass. While the success of the land under grass depends, to a considerable extent, on the quantity of manures applied with the fallow crop, still the kinds of grass seeds which have been used in sowing it down have a very important influence on the pasturage. It adds, no doubt, to the expense, to give 30 or 40 tons of farmyard manure to the acre of turnips, besides auxiliary fertilisers; but certainly, on poor peat, liberal treatment always pays better in the end then a niggardly course of management.

With the view of giving a close sweet sward of grass, the following mixture of seeds may be used per acre:—

	lb.
Common ryegrass (*Lolium perenne*), . . .	12
Italian ryegrass (*Lolium Italicum*), . . .	4
Yorkshire fog (*Holcus lanatus*), . . .	1
Rough-stalked meadow grass (*Poa trivialis*), . .	2
Foxtail grass (*Alopecurus pretensis*), . . .	1
Hard fescue grass (*Festuca duriuscula*), . .	1½
Meadow fescue grass (*Festuca pratensis*), . .	1
Fiorin (*Agrostis Stolonifera*), ...	1½
Timothy grass (*Phleum pratense*), . . .	4½
Water grass (*Poa fluitans*)	1
Birdsfoot trefoil (*Lotus major*), . . .	2
Yellow clover, or black medick (*Medicago lupulina*), .	2
Cowgrass (*Trefolium pratense perenne*), . .	1½
White clover (*Trefolium repens*), . . .	6
	41 lb.

It will rarely be advisable to take a hay crop off land of this nature; the sooner it is thrown into permanent sheep-pasture, so much the better. By means of suitable top-dressings it can afterwards be kept in any state of fertility which is thought advisable, and under good management it may certainly be made very fine pasture. To have produced such effects from so bad a subject to begin with as a cold wet flow-moss, will always be a source of satisfaction to the improving landlord. The pecuniary view of the improvements cannot be expected to be very promising for a few years at the first, for the scanty crops must bear a very low proportion to the heavy outlay incurred; but regarding the expense as the mere purchase price of the improved land, the result will often be highly satisfactory. Taking the course of cropping, in the reclaiming operations, as suggested in a previous page—namely,

first, oats; second, oats; third, turnips; fourth, oats; and, fifth, permanent pasture—the expenditure and income may be estimated as in the following table. It is perhaps necessary, however, to state, that it is only in cases where the turf is difficult to rot that two white crops in succession should be taken. The practice is not commendable in all cases, but in some it is so, and if a sufficient quantity of guano is applied, it is really not so bad after all. Considering, also, that sufficient time is thus allowed to rot the turf, which, on the land being wrought for green crop, is well mixed with it, there is decidedly an advantage gained in many instances.

Reclaiming of Peat-Moss.

EXPENDITURE.	£	s.	d.	INCOME.	£	s.	d.
Forming open drains, as particularised in a previous page, per acre, ...	£1	15	0	Oat crop of first year, say 3½ quarters, at 20s., . . .	£3	10	0
Deepening 44 rods of 5½ yards, of open ditches from 3 to 4 feet to receive tiles, laying the pipes, and filling the drains to nearly the surface-level at 8d.	1	9	4	Straw, 1 ton, ...	1	5	0
Extra for main drains, .	0	3	8				
Pipe-tiles required per acre, 700, which, including cartage, extra calibre of main tiles, collars, and cartages, may be taken at 32s. 6d. per 1000,	1	2	9				
Lime applied at the rate of 8 tons per acre, at 8s., . . .	3	4	0				
Cartage and labour applying it,	1	0	0				
Cost of digging 10 to 12 inches deep, and levelling the surface where not cut up by gulleys of more than ordinary depth, per acre, ...	4	0	0				
Guano applied to first oat crop,	1	12	0				
Seed oats, harrowing of land, and reaping of crop at harvest,	2	5	0				
State of accounts per acre after first harvest, . . .	£16	11	9		£4	15	0
EXPENDITURE, SECOND YEAR.				INCOME, SECOND YEAR.			
Applying 100 carts of earth at 9d., ...	£3	15	0	Oat crop, 6 quarters, at 20s.,	£6	0	0
Ploughing and harrowing land,	0	12	0	Straw, 1¾ tons, ...	2	3	9
Seed oats, reaping and carrying home at harvest, . . .	1	13	0				
Guano, 2¾ cwts., ...	1	12	0				
Interest on previous outlay at 5 per cent, ...	0	11	10				
State of accounts at end of second year, ...	£24	15	7		£12	18	9
Carry forward, .	£24	15	7	Carry forward, .	£12	18	9

EXPENDITURE, THIRD YEAR.				INCOME, THIRD YEAR.			
Brought forward,	£24	15	7	Brought forward,	£12	18	9
Ploughing land with 3 horses a-breast, 10 to 12 inches deep,	0	15	0	Value of turnips, 20 tons per acre, ...	7	0	0
Spring working, drilling and sowing turnips, &c., .	1	5	0				
Farmyard manure, 25 tons at 4s.	5	0	0				
Guano and other portable manures, ...	2	0	0				
Summer working of root crops (turnip tops paying for lifting),	0	15	0				
Interest on previous outlay at 5 per cent, ...	0	11	10				
State of accounts at end of third year, ...	£35	2	5		£19	18	9

EXPENDITURE, FOURTH YEAR.				INCOME FOURTH YEAR.			
Ploughing and harrowing for grain crop, . . .	£0	12	0	Oat crop, 8 quarters at 20s.,	£8	0	0
Seed oats, sowing, and harvesting of crop, . . .	1	15	0	Straw, 2¼ tons, . . .	2	16	3
Procuring and sowing permanent grasses, ...	1	2	0		£30	15	0
Interest on previous outlay at 5 per cent, . . .	0	15	2	Excess expenditure over income, ...	8	11	7
State of accounts at end of fourth year, ...	£39	6	7		£39	6	7

After a rotation of this nature, the ground will have been laid down to pasture, and on a low estimate it will be worth a free rental of 15s. per acre. Taking this rental at twenty-eight years' purchase, the value of the land by the acre will be £21; but the price paid for the ground in improving it, assuming that it could not be worth anything before the reclaiming operations began, is only £8, 11s. 7d., which is equivalent to a rental of 6s. 1½d. an acre, at twenty-eight years' purchase. It appears, therefore, that on very moderate calculations, so far as the income during the improving operations is concerned, a sufficient margin will be left to render improvements even of flow-mosses safe. The estimated expenditure in the foregoing accounts, if a few pounds for survey, levels, and professional advice, where these are required, are added, is quite sufficient to cover the actual necessary outlay; and unless the peat operated upon be of the very worst description, there is little likelihood of the returns being below the amounts stated. To give 5 per cent on the balance still unpaid when the land has been put into grass, it will only be necessary that it should be worth 8s. 7d. an acre, a rent which would certainly be very moderate after so much outlay.

A practical illustration.—The only case in which the principles of reclaiming peat-moss recommended in the preceding pages, have been put into operation on anything like an extensive scale, is not sufficiently advanced to admit of the effects being fairly

judged of. But so far as the reclaiming works have proceeded, they are highly satisfactory, and if persevered in, will ultimately remunerate the spirited proprietor, as well as the tenants who are to pay interest on the outlay.

On the farms of East and West Bretton, in the parish of Annan, Dumfriesshire, there is a peat-moss lying on the new red sandstone formation, which extends to about 120 acres, and varies in depth from 10 to 14 feet. Previous to the spring of 1854 it was lying in so wet and spongy a state, that it was nearly impracticable to cross it dry-shod. Though almost covered with water, the surface, however, was pretty closely swarded with large tufts of coarse aquatic grasses; but for pasturing purposes it was altogether valueless. On the writer being employed in January 1854 to report on the condition and capabilities of the Bretton farms, he took occasion to advise the reclaiming of the moss on the principles and for the reasons which have been fully stated in previous pages of this essay. His report having been approved of by the proprietor, preparations were made for beginning operations on the moss as speedily as possible. The first step taken was to lay out on a plan the forms and sizes of the various contemplated fields, and the outlines and extent of a number of shelter strips and clumps of timber which it was proposed should be planted. With the view of saving expense, the writer did not recommend the laying down in the plan of contour lines, though in most cases this would be advisable. In April 1854 the open drainage was commenced, and as many as eighty workmen were soon obtained, so that the whole work was completed within a few weeks. From the peat being of a very fibrous nature, and so excessively wet that the sides of the drains in the least fibrous places ran together often as soon as they were opened, the expense was considerably more than it would be in many other cases. The open cuttings were from 60 to 65 feet apart, the common drains being from 3 to 4½ feet, and the main drains from 6 to 10 feet in depth. On the completion of the drainage, it was found that the expenditure amounted to nearly £200, which, as there were only about 100 acres drained, was nearly 40s. per acre. During the summer months the effect on the surface of the moss was very astonishing. After an extraordinary current of water had poured out from it for several weeks, the surface began to get drier, and huge cracks and fissures rent the peat to a depth of several feet. The subsidence continued gradually during the summer, till towards autumn the general surface was at least a foot to 14 inches lower than it had been six months previously; and one of the neighbouring farmers affirmed that he could then see objects at a distance over the surface of the moss which previously were not in view. In forming the outlines of the intended plantations, all that could be done the first year was to cut a large open drain as the boundary; but the clumps will afterwards

be planted with Scotch firs, and hedges of alder will be put in round about them.

As the improving operations progress, I have every reason to believe that they will give even a more satisfactory profit than what has been estimated in these pages as likely to be realised on such improvements.

The only other case to which I need refer as illustrative of the importance of improving peat, is that of part of a large flow-moss on a property in Lanarkshire, which has been very successfully reclaimed. In some respects the improving operations were not conducted so judiciously as they might have been, the drains being put in at a less depth than was requisite, and the expense of cultivation the first year more than could be expected to pay; yet the returns have been very satisfactory. This moss, which is on the cal formation, varies in depth from 8 to 12 feet, and is much less improvable than the Bretton moss already referred to.

It consists in a great measure, at least on the surface, of fallen heather blooms, and consequently without a liberal application of earthy matter it can scarcely be reclaimed with advantage. After the part which has been improved was drained with tiles and soles to a depth of from 4 to 5 feet, the surface was dug, and a very heavy dressing of earth-and-lime compost was applied. Except turnips, no other crop was taken till it was laid down to grass, and after having been in pasture for two years, I saw it in the summer of 1854, growing a very fine root of white clover, and having all the appearance of old rich pasture-land. In the circumstances, I could not value the land at less than 15s. the imperial acre; and assuming that the expense of reclaiming was even more than the estimates given in a previous page, which I believe it really was, yet there was enough to convince me that the improvement had been a remunerative one; and I have no doubt that several hundred acres adjoining will, at no very distant period, be reclaimed on some similar principle. Having treated so fully of the cultivation of peaty deposits, I will now proceed to the second primary section of this paper.

II. *Waste land partially useful.*—Under this section all the various kinds of land may be treated of, which, either from being in pasture, or from their yielding a small return for some other purpose, are worth a low rent annually. In laying down rules for improving soils of this class, it will be obvious that, though perfectly sound as general principles, they cannot be regarded as applicable in every case. The variations of soil and climate are so numerous, that certain modifications, according to circumstances, must be adopted.

In the remarks I have to make in this department of the subject, I will not divide the various kinds of soils into their proper geological sections, as doing so would take up too much space. I will be contented to speak of the different orders of soils which

can be reclaimed without trenching,—but which may with advantage be trenched—such as are found on the coal, the lias, the red sandstone, and various other geological formations; and of those which in general require to be trenched—such as are found on the greywacke, the granite, the gneiss, and other geological measures, having equally stony surfaces.

The herbage of all these soils is generally of a very scanty and innutritious nature, consisting principally of stunted heather, ling and carex grasses. Where the surface is tolerably level and free from stones, a higher rent is sometimes realised by its being let as exercising-ground to the owner of some neighbouring stud of horses, than it would naturally bring for pasturing purposes, and in any case the class of land particularly referred to seldom yields more than 5s. an acre—not altogether valueless, but still worth a mere trifle after paying for the care and management bestowed upon it. That such ground may in very many instances be improved with advantage, cannot for a moment be doubted by any one who has given attention to the subject of land improvement in all its bearings. Suppose an extensive sheet of moorland to be presented before the imagination; the surface is slightly undulating, but not very stony, and being covered with a close brown coat of heather and dwarf grasses, it has rather a warm and clad appearance than the reverse. If the proprietor thinks he would prefer a crop of yellow waving corn to brown dangling heath, certain grave questions must be settled before an onward movement is made in the desired direction: Is the climate tolerably good? What is the altitude? What sort of soil and subsoil has it got? All these questions should be satisfactorily answered before operations are commenced. If everything appears favourable, the order in which the works should begin may be stated as follows:—

Drainage.—The first improving operation must of necessity be in most cases thorough drainage, and if practicable it ought to be undertaken rather in the summer than the winter time. The depth and distance apart of the drains will depend on the porosity of the subsoil. With ordinarily tenacious soils, 4 feet deep and from 24 to 30 feet apart will be good drainage; but where there are gravel beds and under springs, or if the soil is much hoven with moisture, the depths must, and the distances apart may, be a great deal more than here stated. In some cases it is practicable to use a large drain-plough with advantage in beginning the drains, but where there is no such implement at hand, recourse must be had to the spade. If there are any old furrows in the ground running in the same direction as the drains, no attention should be paid to them unless it happens that, in laying off the drains at the regular distances fixed upon, they occasionally come accidentally into the furrows. Where there are gulleys or deep furrows to be filled, some of the clay taken from the drains should be thrown into them, and the good surface-soil will thus be saved. The

drains should be laid off as straight as possible, and after they are completed, an accurate plan ought to be made of them, so that in the event of any drain giving way, it may be hit upon at once by simply taking a measurement from some point shown in the plan. If the subsoil is solid, there is no need for collars being used with the pipes, which in almost all cases are better without them. Collars make the pipes lie with a bossage, and hence they are more liable to be broken or displaced than if they were resting solidly on the bottom, while they admit mud as easily between the collar and the pipes as the pipes without collars do at the ends. At the upper ends of the drains, 1½-inch pipes will do for 80 or 100 yards, but below that, 2-inch pipes will be necessary. The drains should never be cut wider than the pipes, and after the latter are laid they ought to be carefully covered with a slice of clay taken off each side of the drain just above the tile. When these slices are neatly folded over each other, and slightly pressed with the foot, an excellent roof is formed above the pipe, which in this way lies much cleaner than it could do if covered with turf or soil. In many instances, particularly where the surface-soil is soft and "deaf" in its nature, it is of importance to keep as much of the clay dug out of the drains on the surface as possible, to mix with the soil. Of course, the drains in that case must be filled with soil, or they may be levelled with the surface by a spade being used to dig down the sides left standing above the paring of clay next the pipe. After the drains are completed, and the discharging outfalls each finished with a built stone mouth, further operations will require to be gone into without delay. If the drainage has been completed by midsummer, it is of the greatest advantage that the soil should be turned up before the best of the weather is over for the season. Some have recommended paring and burning on all rough land, but under a heading by itself I hope to be able to show that it is only in some cases that this system can be undertaken with advantage. Whether trenching or ploughing is to be the mode of cultivation now adopted must depend on several circumstances. If the surface is very uneven, and cannot be levelled by deep ploughing, and if workmen are numerous in the district, and wages not very high, then trenching is to be preferred to ploughing. But if the reverse is the case, and there is sufficient horse-power at command, then ploughing must be had recourse to. There is no doubt that trenching affords the most direct and ready means for getting the land brought speedily into a profitable state, and in many instances it will be found to pay better than mere ordinary ploughing, which, however, is not nearly so good as trench-ploughing.

Mode of trenching.—If trenching has been resolved upon, the best course to adopt is to plough the land first with a very ebb furrow—so ebb and narrow, indeed, as merely to be laid completely

over on its back. For this purpose it is necessary to have the wing ("feather") of the ploughshare ("sock") pretty broad, sharp on the edges, and perfectly flat. Before the plough is set in motion, it may be requisite to cut over the surface growth, that it may be conveniently buried. On the ploughing being performed up and down the ridges, the trenching should be commenced across, from furrow to furrow. Should the land be in ridges, each workman takes the whole breadth of a ridge before him; or in absence of furrows, the ground can be laid off in breaks for the purpose, and, cutting out a trench transversely to the plough furrows about 2 feet wide and 14 inches deep, he commences work. He then sets his line so as to take in 2 feet of new ground the entire breadth of the ridge; and having cut through the plough furrows crosswise, he lifts with his hands the pieces cut off, and lays them closely together with the heather side uppermost in the bottom of the trench previously formed. A spading as deep as can be drawn is next dug out from the new trench, and put on the top of the turf placed in the bottom of the previous trench. After this the bottom of the trench is shovelled out, and the mould thrown on the surface of the wrought ground, to level it and fill up the interstices. The depth of the trenching must depend on the nature of the soil and subsoil, but in most cases 14 or 15 inches, measuring the solid depth, will be sufficient. If the natural inequalities of surface are great, they should be helped by shifting the clay in the bottom of the trench from the higher to the lower parts, rather than by burying a large quantity of soil to secure a fair surface-level. After the trenching has been completed, there are various ways in which the land may be put under crop. If suitable for raising wheat, the surface might be well wrought and sown with this crop in the autumn of the year in which the trenching has been performed. In most cases, however, land originally of so little value is ill adapted for the growth of wheat, and hence, in general, it is better to follow a course of cropping, better suited to its condition than this could possibly be. One great advantage of trenching is, the facilities it affords for putting the land at once under a green crop; and assuming that this opportunity is to be embraced, the system on which the land may be managed will be stated in order. If the trenching has been completed before the approach of winter, it will be all the better for the soil. The more it is exposed, first to drought and then to frost, the easier will it be to work afterwards; and considering that in most cases a good deal of clay will have been brought to the surface, it will be obvious that atmospheric action is indispensable in reducing the tenacity of the new soil. During winter nothing can be done to the ground previously trenched, but manure-heaps may be prepared; and on dry spring weather having fully set in, the grubber should be put in motion with the view of preparing for a crop of turnips.

Only one light ploughing will be necessary, and that more for the purpose of thoroughly mixing the new soil than for increasing the amount of available mould. On such ground it is often practicable to get the turnips sown at a very early period of the year, and hence the crop is of much value in many instances from being available for autumn house-feeding of stock. With comparatively little spring culture, the land may be drilled and sown with globe and yellow turnip-seed by the middle of April. The application of manures need not be very heavy—say, even on very poor land, from 16 to 20 tons of farmyard dung; and of auxiliaries, 2½ cwt. of Peruvian guano, and 1½ bushels of dissolved bones per acre. Care should be taken to prevent the drills being made too high, as in that event the roots of the plants fail to reach the decaying turf as soon as they ought to do. In most cases the turf may be made to act as an excellent manure to a turnip crop; but with oats instead of turnips the case is different, as the roots are scarcely able to go down through an 8-inch bed of poor soil to reach the turf. On the turnip crop being all removed from the land, except the tops, which must be scattered over the surface, the plough should be set in motion to prepare for the oat crop of the second year. The furrow ought to be of sufficient depth to lift all the soil off the turf, but not to disturb it. With the oats sown in the following spring 2 to 3 cwt. of guano should be applied, or 1½ cwt. of guano and 80 or 90 lb. of nitrate of soda will give a good crop. As soon after the oats have been reaped as possible, a large fallow-plough, drawn by three strong horses yoked abreast, should be set in motion, and a furrow must be given sufficiently deep to go to the bottom of the trenches formed two years previously. From the subsidence a depth of 12 inches will acomplish this, and the rotted turf now brought to the surface, and laid with the heathery side down, will be well prepared in the following spring for being torn to pieces and mixed with the soil. The crop of the third year may be potatoes, carrots, khol-rabi cabbages, or mangold-wurzel. Preparatory to the seed sowing, the grubbers, brakes, and harrows will have some work to tear the turf to pieces, but this may easily be accomplished if attempted only when the ground is dry. Another light application of farmyard manures may be given along with a hundredweight or two of guano and bone-dust; and with proper care in the culture, superior crops may be relied on, unless the soil is very inferior. If the soil be of such a nature as to justify the use of lime, it may be applied in a powdery state to the drills before the potatoes braird, at the rate of about 8 tons per acre. With other green crops, say mangold or turnips, it can be given just after they are thinned, and before they are hoed. Should the lime be applied at an earlier period of the rotation, it would be likely to be altogether buried; but if given now, it will be brought into direct contact with the reduced turf,

and greatly improve the pasturage in following years. To prepare for the fourth crop of the rotation—which, with the view of leaving something to balance against the heavy outlay incurred, may be wheat, if the soil and climate are suitable, and oats if not—an ordinary furrow, such as is usually given in the ploughing up of potato land, will be sufficient. With the white crop, the land should be sown out to grass, and such a mixture of natural and artificial grasses will require to be given as the nature of the soil and climate may render necessary to insure a close and nutritious herbage. The crop of oats will, on ordinary soils, be a very heavy and valuable one, and help considerably to reduce the improving outlay. It will rarely be judicious on such land to take a hay crop. The apparent profit which the hay will give, may seem to imply that this opinion is unsound; but when it is remembered that the hay crop is obtained at the expense of the soil's fertility, and that the pasture and after crops must be injured in consequence, it will appear prudent to dispense with a cutting of hay. With such a course of cropping as has just been suggested, the land on which the reclaiming operations have been set afoot, will soon be brought into a high state of fertility, and being laid down to grass without that which has been put into the soil being hastily taken out again, the pasture is likely to be of superior quality, if judicious care has been taken in the selection of proper seeds. The pecuniary view of the improvements on one acre under the trenching system, in contrast to figures which will be given further on in reference to reclaiming altogether by the plough, may now be shortly stated.

Waste Land Reclaimed by Trenching.

EXPENDITURE, FIRST YEAR.				INCOME, FIRST YEAR.			
Drainage 4 feet deep and 24 feet apart, ...	£6	0	0	Value of turnip crop, . .	£8	0	0
Skim-ploughing, &c., . .	0	10	0				
Trenching 14 inches deep, .	6	5	0				
Spring-working for turnip crop,	0	15	0				
Manures, ...	5	10	0				
Summer work, . . .	0	15	0				
Close of 1st year, .	£19	15	0		£8	0	0
EXPENDITURE, SECOND YEAR.				INCOME, SECOND YEAR.			
Interest on outlay of last year,	£0	11	9	Value of oat crop, . .	£8	0	0
Ploughing, sowing, harrowing, and reaping oats, . .	2	5	0	,, of straw, after deducting threshing, &c., . .	2	3	9
Guano, ...	1	10	0				
At end of second year, .	£24	1	9		£18	3	9
EXPENDITURE, THIRD YEAR.				INCOME, THIRD YEAR.			
Interest on outlay of previous years at 5 per cent, .	£0	5	10	Value of potatoes, 5 tons at £4,	20	0	0
Deep ploughing, . .	0	15	0				
Carry forward,	£25	2	7	Carry forward,	£38	3	9

	£	s.	d.
Brought forward,	£25	2	7
Spring working, ...	1	12	0
Seed potatoes, ...	4	0	0
Manures, ...	6	0	0
Lime, ...	3	10	0
Summer working and lifting potatoes, ...	1	12	6
At end of third year,	£41	17	1

	£	s.	d.
Brought forward,	£38	3	9
	£38	3	9

EXPENDITURE, FOURTH YEAR.

	£	s.	d.
Interest on outlay at end of last year, ...	£0	2	8
Ploughing after potatoes, sowing, harrowing, and harvest- of crop, ...	2	7	6
Grass seeds, ...	1	2	0
Guano, ...	1	10	0
Outlay at end of fourth year,	£46	19	3

INCOME, FOURTH YEAR.

	£	s.	d.
Value of oat crop, . . .	£10	0	0
Straw, after allowing for threshing, &c., ...	2	12	6
Income at end of fourth year	£50	16	3

It will thus be seen that, according to these very reasonable calculations, a profit of £3, 17s. will be realised per acre, after paying 5 per cent interest on the outlay from year to year. But suppose the land in its original state to have been worth 7s. 6d. per acre, and that 5 years' rents must be allowed, counting the one in which the trenching began, the accounts will still show a profit on the improvements of nearly £2 an acre. Besides this, however, the increased intrinsic value of the land must be taken notice of; and assuming that the outlay and income just balanced each other at the end of four years, we will see how much the land is higher in value.

	£	s.	d.
Original rent of 7s. 6d. an acre, at 28 years' purchase, .	£10	10	0
Rental of improved land, 20s. an acre, at 28 years' purchase, ...	28	0	0
Clear profit per acre from the improvements, . .	£17	10	0

This sum may be thought too small to cover all contingencies; but the way in which the expenditure and income have been estimated, leaves little risk of mishaps materially affecting the money results. The only crop which has any likelihood, on land of ordinary quality, of being less than the amount stated, is the potato one; but in some years it would be much more than has been assumed; and granting that it were only half the worth it is rated at, still there would be a sufficient margin left to make the improvements remunerative. On soils of a highly improvable character, under a good climate, much better returns than these may be safely relied upon, provided the works are undertaken and carried out skilfully as well as cautiously.

Plough culture.—The next department of the subject to come under consideration is, the reclaiming of land which happens to be

tolerably free from stones, by ploughing in contrast to trenching. We have seen the estimated returns from trenching, and if the calculations relate to the same class and quality of land, the outlay and income may be fairly compared. Before giving the money figures, however, it may be well to state the course of cropping which can be followed with the greatest likelihood of success. If the ground is covered with heather too rank to be buried under a strong plough-furrow, it should be cut down with a stout garden-scythe. The ploughing operations should begin in early winter—indeed, as soon after harvest as practicable; and in most cases the furrows ought to run up and down the ridges, or, in absence of ridges, in the direction of the greatest natural fall. It is needless to think of ploughing rough land effectually without a plough made specially for the purpose, large and strong in every part, having abundance of coulter "redd," and great width and power in the wrest. Such a plough must be drawn by three powerful horses abreast, yoked either with equalising iron trees, or with a wooden tree having a short and long end, along with the ordinary swingle-trees. The latter mode of yoking is simpler than the other, and in many cases is even preferable. For a short time strange horses do not work well together yoked abreast; but if they are equally matched, and not too harshly used, they soon get accustomed to this kind of yoke; and while much stronger and steadier than two horses behind and one before, they rarely require a driver in addition to the ploughman. Assuming that the plough and its fittings are all ready at the close of harvest, the work should be started without delay. Beginning at the furrow, the ridges or breaks should be split out with a furrow at least 10 inches or a foot broad, and from 8 to 10 inches deep. The more completely the furrow is laid flat over on its back the better; and with a good ploughman and plenty of horse strength, the work is easily done. Of course, the "feather" of the "sock" should be flat and broad, and there ought to be no "cut" on the plough irons. In terminating the break, the "hinting" furrow is better not to be "ripped." It is preferable to go over these furrows after the completion of the field with a plough without the wrest, or a good drill-grubber, so as to loosen up the soil, and thus secure a crop in the furrow as well as on the rest of the ridge. Some have argued that, in ploughing rough ground, it is better to give a shallow furrow, and thereby keep the decaying sward near the roots of the corn crop. I have seen both systems of ploughing tried very extensively; and in one case, two fields, tenanted by different parties, were ploughed at the same time on the contrasted principles. There was very little difference of the land, and the crop was sown in the one case with the same advantage as in the other. At harvest the deeply-ploughed ground had a heavy excellent crop, while the other field of oats was so poor as to be

scarcely worth the reaping. There is so much danger of the crop being injured by drought when rough land has been ploughed with a shallow furrow, and withal so little mould to cover the seed, that it certainly is not a system to be advised in such cases. On the other hand, when a deep furrow has been given, there is abundance of loose soil to cover the seed, and the drought has very little effect on the crop. Another and very important advantage obtained by deep ploughing is the facility it affords for allowing the turf to lie untouched with sufficient workable soil above it, till it is well rotted, and ready for being mixed with it. In the seed-time following the first ploughing, as early as the weather will permit, a crop of oats, with from 2 to 3 cwt. of guano, or some nitrate of soda as a substitute, should be sown. As the soil will be well frosted, there will be no difficulty experienced in covering the seed; and it may even be necessary to prevent a too deep covering by giving a single "tine" of harrowing before committing the seed to the ground. The first crop on soils of ordinary quality is likely to be tolerably good, though inferior to the second one. To give the turf time to decompose, it is usually advisable to take a second oat crop; and in ploughing the land for it, a shallow furrow is best. By ploughing only a few inches deep, and, as it were, splitting the deep furrow of the previous year, the tough sward remains buried, and yet sufficient new soil is brought up to raise an excellent crop, if guano is applied as with the first crop. In almost every case the second oat crop is the best on this class of land; and any little drawback which may be entailed by two white crops being grown in succession, is far more than compensated for by the facilities which the practice affords to thoroughly rot the untouched sward. The third year the land should be under green crop—either potatoes or turnips—and to prepare it properly a very deep cross-ploughing will require to be given as soon after harvest as possible. In most cases it will be quite easy not only to turn up the old surface-furrow, but to lay an inch or two of fresh earth or clay on the top of it. By the deep furrows being made to run across the drains, the action of the latter is greatly improved, this system of ploughing, in absence of more expensive subsoiling, being an excellent substitute for it. The following spring will bring round the operations of grubbing and fallow-pulverising, and the green crop may be got early in with a good dressing of farmyard and other manures. It is often a mistake to give a stinted application of byre and stable manures to poor new land. In most cases 30 tons an acre pays better than 20, and I have seen instances in which 40 tons had a very excellent and profitable effect. With 20 to 30 tons, however, and a liberal supply of portable manures, very fine crops may be grown. As a necessary consequence, the decomposed rough sward acts in a very effective manner as a manure, and greatly increases the soil's productiveness. Lime should now be

applied in a similar manner to that recommended in a previous page, where trenching is supposed to be adopted instead of ploughing. Of the mode of working the green crop it is unnecessary to say anything, the common rules being applicable in such a case with but very little variation. After roots comes a crop of oats, sown with guano as before, and the land is then laid down to pasture with a mixture of artificial and natural grasses.

The outlay and income per acre by this course of improving operations may be estimated as under:—

Expenditure	£	s.	d.	Income	£	s.	d.
EXPENDITURE, FIRST YEAR.				INCOME, FIRST YEAR.			
Draining 4 feet deep and 24 feet apart,	£6	0	0	Value of oat crop	£5	0	0
Deep winter furrow, with three horses abreast,	0	15	0	Straw, after deducting allowance for threshing,	1	5	0
Seed-corn, harrowing, sowing, and reaping,	1	15	0				
Guano, 3 cwt.,	1	16	0				
At close of first year,	£10	6	0		£6	5	0
EXPENDITURE, SECOND YEAR.				INCOME, SECOND YEAR.			
Interest on outlay of last year,	£0	4	0	Value of oat crop,	£8	0	0
Ploughing, sowing, harrowing, and reaping oat crop,	2	5	0	Straw, less threshing, &c.,	2	3	9
Guano,	1	10	0				
At end of second year,	£14	5	0		£16	8	9
EXPENDITURE, THIRD YEAR.				INCOME, THIRD YEAR.			
Autumn cross-ploughing, with three horses abreast,	£0	15	0	Interest on profit of last year,	£0	2	2
Spring working,	1	12	0	Half acre of potatoes, 2¼ tons, at £4,	9	0	0
Manures,	6	0	0	Half acre of turnips,	4	0	0
Half acre potato seed, the other half acre being turnips,	2	0	0				
Lime,	3	10	0				
Summer working and lifting of crop,	1	10	0				
At end of third year,	£29	12	0		£29	10	11
EXPENDITURE, FOURTH YEAR.				INCOME, FOURTH YEAR.			
Ploughing after green crop, sowing, harrowing, and harvesting of oats,	£2	7	6	Value of oat crop,	£9	5	0
Grass seeds,	1	2	0	Straw, after allowing for threshing, &c.,	2	5	0
Guano,	1	10	0				
At end of fourth year,	£34	11	6				
Profit on improving operations, without allowing for the original rent of the land,	6	9	5				
	£41	0	11		£41	0	11

Taking the original rental of the land at 7s. 6d. an acre, without interest, the profit of £6, 9s. 5d. will thus be reduced 30s.—that is, to £4, 19s. 5d., or say £5—thus leaving a balance of £3 an

acre of profit in favour of reclaiming waste land by deep ploughing against trenching. This result, however, is only arrived at on the assumption that, after the four-shift rotation followed in both cases, the land will be left in as good condition by having been only ploughed as by having been trenched. Now, any one acquainted with such matters must be satisfied that the after crops for many years will be better on the trenched than on the ploughed land. Still the conclusion cannot be avoided that, in point of early returns from a moderate outlay, deep ploughing, on ground not infested with boulder-stones, is to be preferred to trenching. Where there is a deficiency in horse power, and the ploughing cannot be made deep enough, trench-ploughing may be had recourse to. With a good open-wrested plough the furrow can be opened, and one of narrower dimensions may follow in the bottom, and throw out several inches on the top of the reversed surface sward. The value of the ground, after being reclaimed by plough culture, will stand thus:—

Original rental, 7s. 6d. an acre, at 28 years' purchase,		£10 10 0
Profit on improvements, reduced to, say .	£3 0 0	
Rent of improved land, 20s. an acre, at 28 years' purchase, ...	28 0 0	
		31 0 0
Clear profit per acre from the improvements, .		£20 10 0

These returns may even in some cases be increased, particularly if the soil is suitable for growing wheat instead of oats; but in any case they will be sufficient to cover all unforeseen risks, and make the reclaiming of waste land, of fair natural quality, a perfectly safe investment.

The assumed rental, after the first course of cropping has been gone through, cannot be regarded otherwise than reasonable—instances being known to the writer in which higher rents than 20s. an acre have actually been obtained for land which originally was of less value than 7s. 6d. per acre.

Waste land infested with stones.—In the estimates given, both under the trenching and ploughing systems of improvement, no allowance has been made for taking out land-fast boulder-stones. In the granite and gneiss districts, as well as other stony ground, it is of course impossible to undertake improving works except by trenching; and here, too, the draining is generally more expensive than on softer land. Assuming it to be necessary to add, for the increased labour on stony soils, from two to three pounds an acre to the estimates of trenching land free from stones, as given in a preceding page, still there will be a good margin left for profit. There are other variations also which help to increase the returns from the improvement of such ground. Originally the land is of very little use, if the surface is thickly covered with stones; and

hence, while in most instances it will be worth 20s. to 25s. an acre after being improved, the lowness of its original value adds to the profit of improving it. In numerous instances, then, it appears that improvements of unremunerative land, if undertaken judiciously, may be made to pay, and that in consequence the productive power of this country might be very largely increased without individual interests being injured by the undertakings calculated to bring about this end.

Effect of climate on improvements.—It will be obvious that the profitableness of agricultural improvements must depend, to a very considerable extent, on climatic influences. There are farms which, though situated at a very high altitude, are yet, from being surrounded at no great distance by warm cultivated plains, and partly from being under the influence of sea-breezes, earlier, and have a much better climate, than ground of the same height lying farther inland, and more in contact with the vapours of cold undrained heaths. Whatever the cause may be, proprietors may rest assured, that if the climate is so bad that grain, even on dry sheltered spots, very rarely ripens in any year, it will be a mistake to reclaim by culture any great extent of their waste ground. Draining and good cultivation improve a climate, but they can never make one. But waste land can be greatly improved without being cultivated. By putting in either catchwork surface drains, or, in conjunction with these, here and there, in spouty places, a deep covered drain, the pasturage may be very much benefited.

Where the soil does not naturally contain lime, a coating of this mineral on the surface, applied as hot as possible, will sweeten the pasture and increase the value of the ground. Even on rough land that may subsequently be broken up, a liberal dressing of hot lime does a great amount of good, both to the pasturage, and to the crops grown after it has been ploughed.

The use of lime.—A few short general rules on the subject of lime application may here be stated.

1st, Lime is a decomposing, and therefore a scourging agent. In soils containing inert vegetable matter it acts very effectively, by decomposing and rendering them fertilisers; but in land which has long been under the plough, and consequently containing little vegetable matter, it is a scourge of the worst kind, unless accompanied with farmyard or other manures.

2d, Lime, to do the greatest amount of good of which it is capable, should be applied to waste land in a dry state, and be brought into contact with the vegetable matter which may be present in the soil. For this purpose it is always used with the greatest advantage on pulverised ground which happens to be tolerably dry at the time of its application. And,

3d, Lime used in well-managed composts will generally go a greater effective length than when applied in any other manner;

and as an agent for converting dried peat into a valuable manure, it cannot be equalled by any other decomposing agent.

The general conclusion deducible from these rules is, that in all rough unremunerative land, lime is a most important and almost indispensable application in successfully improving them.

Paring and burning.—This system of improving land has now very justly fallen out of repute; still there are individuals who continue to recommend it, and some farmers are so wasteful as to adopt a somewhat similar practice in destroying the rack gathered from their fallow fields.

The theory of paring and burning is very easily explained. By the heather turf being burned an ash is produced very similar to wood ashes; and as some of the earthy matter becomes calcined, the effect of the burning on the soil is both chemical and mechanical. But it exhausts the land; and though two or three very good crops may follow the practice, ultimately it does more to injure the ground than is generally supposed. Considering the large amount of carbon sent into the atmosphere in the form of smoke during the burning operations, the loss the farmer sustains must be immense. It is a quick way of improving, but a very injudicious one, and should rarely be adopted. It has been tried with the view of destroying wire and grub worms; but it is an expensive cure, if it can be depended on as one, and it cannot be so except for little more than a single year. Liming the sward, and allowing it to lie for a few years till a sweet pasture is produced, is better calculated as a permanent means of destroying these pests.

It is rarely the case, however, that land, ploughed as deeply as heathery ground ought to be when first broken up, is troubled with wire or grub worm, and hence paring and burning are of no use for this purpose on land such as these pages refer to.

Waste land actually reclaimed.—Having stated so fully the best apparent systems of improving different kinds of land lying waste, it is only necessary, in drawing this paper to a close, to give some particulars in reference to ground actually improved on the principles set forth in these pages.

In the Middle Ward of Lanarkshire is situated an estate of several thousand acres, a large breadth of which, seventy or eighty years ago, consisted of moorland of very little agricultural value. Year after year, during the lives of two or three spirited improving proprietors, the poor heath-clad open wastes were enclosed with good hawthorn and beech hedges, and sheltered with suitable plantations and clumps of timber. By the year 1848, when the improvements I am more particularly about to notice were begun, there remained, besides an extensive peat-moss, little more than 100 acres of unimproved ground, but it was so far waste as to be covered with a shaggy coat of brown heath, and fit only for pasturing Highland stirks. As already stated, there had been originally a great deal of poor land on the property, and, from

bad management, some of it had rather been wasted in the reclaiming than improved; but it is not too much to say that the worst had been left to the last. At the time I write nearly all the heather has disappeared from the property, and in the autumn of 1854 might have been seen growing in its place as luxuriant crops of roots and corn, as in districts where the soil is of the best description. The improving works were carried out on two different principles—trenching and ploughing—as will shortly be described. It would be a waste of space to enter into minute details in reference to all the various patches which have been improved during the last few years, particularly as these are scattered up and down the whole estate; and I prefer, therefore, selecting one sheet of very inferior land, the particulars respecting which will be applicable to all the others.

On the bare exposed farm of Lanniemuirs, from 500 to 600 feet above sea-level, the traveller between Glasgow and Lanark by the Carluke road might have observed, in the early summer of 1848, about 30 acres of poor heathery land, pastured by eight or nine small unthrifty queys. One field of nearly 20 acres had then been let for several years as an exercising park to a horse-racer at a rent of £6 a-year, while the other two small enclosures, which were a little better in quality, were let as grass (heather) parks for about £4 a-year. Patches here and there in the large field had for many years been used as a common, from which the neighbouring villagers supplied themselves, without fee or price, with the necessary turf to keep the rigging and skews of their thatch houses in habitable trim. In other parts of the fields, ponds, which in previous years had been used by the surrounding farmers for retting flax in, were now apparently little else than large tufts of rushes, from amongst which might occasionally be heard, in the summer evenings, the monotonous croaking of countless frogs. The soil was thin, and in some places interspersed with layers of coarse white sand; but the subsoil consisted of a good light red sandy clay of the coal measures. Being the worst land on the property, the owner had often been advised to put it under fir timber, inasmuch as it was regarded altogether unimprovable for agricultural purposes. Having been asked, in 1848, to give an opinion of the land, I advised that it should be reclaimed, and accordingly preparations were at once made to begin the undertaking. Of the large field, about 12 acres were selected to be trenched, preparatory to which it was necessary that it should be drained. At that time the value of deep drainage was less generally acknowledged than it is now; and the proprietor being in favour of shallow drains, they were only put in from 3 to 3½ feet deep, but the distances apart were only from 18 to 21 feet. The drains were laid with 2-inch pipes, without collars, and cost per acre about £7. On the completion of a part of the drainage, the trenching operations were com-

menced about the month of July; and labour being scarce at the time, and wages low, the expense per imperial acre amounted only to £4, 13s. 4d. The depth of the trenching was 14 inches; and in every respect the work was performed as recommended in a previous page. Before winter weather set in the whole spade work was over, and in the following spring oats were sown; but unfortunately, from one cause or another, no guano was given, and, as a necessary result, the crop brought only about £3 an acre at a public sale. One acre of the newly-trenched ground was wrought with the grubber and Crosskill crusher, and being dressed with 40 tons of farmyard manure, was put under wheat. At the public sale this acre patch sold at £9, 17s. 6d., and the produce, when threshed, amounted to 6 quarters, weighing 60½ lb. the bushel. In the second year the trenched ground was under Prince Regent potatoes, raised with 25 tons of Glasgow police manure and 3 cwt. of Peruvian guano, and yielded a return of £18 an acre. Corn sown with 2 cwt. of guano was the next crop, and by public auction a price of £9 an acre was obtained. One acre of black Tartarian oats, on a piece of the best trenched ground, yielded no less than 12 quarters of good horse-feeding grain. After oats came a crop of hay, which brought fully £5 an acre; and since then the land has been lying in grass, having been under the second year's pasturage in 1854. It was sublet by the tenant of the farm for both years to a butcher, who paid 22s. an acre of grazing rent. The pasture is of fair quality, and by being top-dressed is likely to be greatly improved. When laid down to grass, the cost of improving had been repaid by the crops; and accordingly, taking the rental of 20s., which is the sum actually paid to the landlord by a good tenant, who entered on a lease of the farm in 1853, a clear profit of 14s. is secured between the original and the present rental, a sum which, at twenty-eight years' purchase, is equivalent to £19, 12s. But the general appearance of the property, at least on the one side, has been so much improved by the removal of the heather, which before the reclaiming operations was always an eyesore, that considerable profit, indirectly, has also been obtained by the effect on adjoining lands. The remaining 18 acres of the 30 more particularly noticed, were drained in a similar manner to the trenched ground, and subsequently cultivated by the plough, according to the rules laid down in a preceding page as applicable to this class of land.

At the end of a rotation—consisting of, 1st, oats; 2d, oats; 3d, green crop; 4th, oats; and, 5th, hay—the cost of improving was more than repaid; and now the land is also let on a nineteen years' lease, at 20s. an acre, with a pre-arranged advance of several shillings to be made in a few years, under certain contingent circumstances. Taking the original rent of this ground at 8s. an acre, the profit, irrespective of the excess income over the outlay, at the end of the first rotation, amounted to 12s., which, at twenty-eight

years' purchase, was £16, 16s. per acre. In carrying out the various reclaiming operations which have been undertaken in different parts of the property in question, it is certainly within the truth to say, that in every case where the management has been anything like skilful, the returns have been greater than those obtained from the waste land on Lanniemuirs farm. Other cases in different counties, in which improvements have been very successfully carried out, might be stated; but unless something new is brought forward, the mere statement of what has been done, and the results which have been obtained, will only be of service in proving the profitableness of such undertakings. To those who are skilful in effecting agricultural improvements, it is unnecessary to give proof of their being remunerative, when properly conducted; and to those who have doubts on the subject, the readiest and most reliable proof will be, to try for themselves what can be done on a *small scale.* If a few square yards of heath become good land when cultivated by a cottager for some years as a garden, extensive fields, under similar management, will not fail to give equally satisfactory results.

REPORT ON STORING TURNIPS.

By Mr James Porter, Land-Steward, Monymusk, Aberdeenshire.

[Premium—The Gold Medal.]

In all seasons the storing of turnips is a desirable and important part of agricultural economy, and the severity of the bygone winter, 1854–1855, rendered it imperatively so. If we can trust to agricultural reports in one of our best-conducted newspapers on farming of the day—and surely they are entitled to a fair share of credit—we may safely infer that the want of storing has this year been the cause of heavy loss in the turnip crop. The *North British Agriculturist*, of date the 11th April 1855, contains reports from more than twenty of our Scottish counties, all complaining bitterly of the great inconvenience and serious loss they have this year experienced from the want of stored turnips. This is tantamount to a charge of negligence on the part of farmers, and the opinions of so many of their representatives we are in some measure bound to believe. It is an undeniable fact that they have never made any *real* move towards the preservation of their turnip crop, nor given to it the same attention they bestow on the other branches of their agricultural departments. Why should the turnip be left exposed and unprotected, at the mercy of every enemy, when it is one of our most costly, most valuable, and most profitable crops? What would the agriculture of this country have been without turnips? This county could have never been, as it may now be properly termed, "the beef depot of Smithfield;" and

one of the most profitable sources ever opened for bringing money into the pockets of the agriculturist would have been wanting.

It may therefore be fairly presumed that the preservation of the *smallest* turnip is matter of *large* importance; and while the crop is left in the field during the winter, exposed to frost and vermin, there will be destruction going on. By stringent means the latter pests may be partially cleared away, but the former agent will take its own course—over it we can have no control; and the only rational alternative left to the farmer is to store his turnips before winter. Seeing, then, that the storing of turnips forms a very necessary and important link in the chain of good husbandry, I shall now endeavour to give a brief outline of the system I have practised for many years, and hope to be able to show that the results have been attended with general good success; and in doing so, I shall treat the subject under the three following heads, viz.:—

1st, The modes and cost of storing.

2d, The results deducible from observation and experiment.

3d, General remarks on the advantages of storing.

First, The time for storing must not commence till the crop is fully ripe, as unripe turnips will not keep in stores:—that period must depend on the season, the date of sowing, and the kind of turnip, whether early or late; but in general (weather permitting) the month of November will be found the most suitable time. Globe turnips I should never think of storing; they should be all consumed by the month of December, their soft nature being ill calculated to stand frost, or to keep well in stores. Swedish turnips, and the best golden yellow, are the most suitable for winter and spring use, and the latter variety should be first stored and first used, as they are quicker grown, and commonly sooner ripe, than the Swedish. In commencing storing, it is necessary that the weather should be moderately dry, although not important that there should be no rain, provided the workers can go on without being drenched. I have seldom noticed any bad effects from the turnips being stored a little damp. It is quite different in the case of frost, for a slight degree of frost in the turnip would breed mischief in the store. Caution is therefore necessary in storing clear of frost, and for that reason the turnips pulled each day should, if possible, be covered up at night. The bulbs should be dressed in the field before leaving the hands of the puller; the tops should be cut off *fully* half an inch clear of the turnip, and the root stript very lightly, just enough to clear away the roughest of the earth and dung adhering to it. In no case should the bulb be touched or cut by the dressing-hook, and the greatest care should be observed in this part of the operation, otherwise the juices will rapidly make their escape, and the whole bulb soon go to decay. The work would be tedious, indeed, to dress every bulb to the exact place, and no farther; but it is better to

leave a little more of the top and root than to break the skin of the turnip in any way. It is not altogether the loss of a few cut bulbs that I deprecate, but the great danger of affecting the rest in the store by the putrid matter from cut turnips. For the same reason, all diseased turnips of any sort should be put aside in the field, and the useful parts of them used without loss of time; they are unfit for a turnip store, and often prove the cause of much mischief. Any turnips in the shape of "finger and toe" should go the same way: although they may appear pretty fresh at the time of pulling, they are sure to go to putrifaction in the store during the winter. In speaking of that mysterious disease called "finger and toe," about the cause of which agriculturists are so much at variance (if I am safe to hazard an opinion on the subject), I may just say, that I firmly believe it to be due to insect life, caused by much decomposing matters in the soil, and the superabundant and long-continued use of warm and fermenting manures. Perhaps the best means of staying the progress of this disease may be found in the application of lime, salt, and other caustic substances, which should be incorporated with the soil before laying down the turnip crop. I have repeatedly noticed marked good effects in the health ofthe turnips by such applications.

In farther pursuing the subject of turnip-storing, the tops should be all left on the field, and turned under by the plough at the time, if possible. Sometimes this cannot be done at once; but whether or not, I have always seen beneficial effects on the succeeding crops of grain where the turnip-tops were left on the land in any shape. They often do more harm than good to cattle, particularly to feeding stock, and may be used with better effect on the field, in shape of manure to the soil. There are only two places on a farm where turnips can be conveniently stored—that is, at the homestead, and in the field; and as each plan must be worked on a different form, I shall here notice them separately.

Firstly, *Storing at the homestead.*—I prefer storing as many here as will last for six or eight weeks. The store may be erected in any convenient place about the stackyard, or as near the byres as possible; of wood, of an oblong shape, from 6 to 7 feet wide, to give room enough for a cart, and 4 feet high. The sides consist of two rows of posts, pitted in the ground about 6 feet apart, and made close between with backs of trees, or any old wood that may be at hand: for the sake of convenience, the store should be erected piecemeal, as the process of filling it goes on. Where wood is scarce, the turnips may be laid down in an oblong ridge, about 7 or 8 feet wide at the base, and sloped off to the top on an angle of 45 degrees; the whole should then be thatched over with 6 inches deep of straw: old thatch from the ricks might answer

well enough for this purpose, fixed down with wooden spars and straw ropes. In stores of this sort the keeping of the turnips depends much on the state of the atmosphere shortly after storing. I have sometimes seen a week or two of misty soft weather prove hurtful in heating the turnips; but some wooden ventilators, placed at regular intervals in the heap, are likely to prevent such an occurrence. Another safeguard is to make the heaps small. These two modes of storing involve about the same expense—8s. an acre, exclusive of carting, which depends on the distance, and in no case have I taken it into account. I should not, however, like to risk large quantities of turnips in this description of stores, and, for spring use, I have always stored them in the soil, where they keep better, and lose less of their specific gravity. I have tried them on the steelyard before and after being stored in the soil for five months, and found the loss in weight to be very small. Not so with the thatched stores, particularly in a very dry windy season, and when left standing till spring. I then found the loss in point of weight to be very considerable. It is therefore desirable that all turnips for spring use should be stored in the soil; and I shall next describe the modes I have used in doing so.

Secondly, *Storing in the soil.*—Take a space of twelve drills wide, from end to end of the field, and pull the two centre drills, throwing the turnips aside; along these drills turn out a heavy plough-furrow, first in the one direction and then the other, thus clearing a hollow from 10 to 12 inches deep. Into this hollow throw the twelve drills of turnips, and trim them up in a uniform ridge, when a double turn of the plough, with little assistance from the spade, will cover them sufficiently from frost and vermin. In this way I have found turnips keep better, and less loss of weight, than in any other way I have tried. The only objection to this plan is the length of time occupied in taking them up, and in wet weather it is difficult to get them anything clean. Another plan I have frequently adopted is to pull the twelve drills, and lay them in three rows, of four drills each, which can be done without hindrance in the process of pulling; then collect them into the centre row in round heaps of about one cart-load each,—and where the crop is good, the distance will not be far to bring the turnips into heaps of that size: a slight covering of mould, from 3 to 4 inches deep, put on by the spade, will in general be found sufficient protection. The roots keep well in this way; and as they can be taken up more speedily, and cleaner, than from the last-mentioned stores, I am most in favour of this plan. The former mode costs 9s., and the latter 9s. 6d. per acre. The cost of storing per acre, in either way, will to some extent depend on the nature of the crop and the rate of wages at the time; but the foresaid prices are an average of what I have paid by contract for several years back, when the work was performed by men, and if it could be done by boys and

women for 10d. or 1s. per day, the expense might be somewhat lessened. But as labourers of that sort are often difficult to obtain, and the season for storing short and precarious, it is perhaps better to do the work by contract at once, and have it finished in due time, even at a small additional expense.

I now proceed to the second division of the subject—viz., The results deducible from observation and experiment—in order to test by experiment the comparative feeding properties of turnips stored in November, and those drawn from the field during the winter and spring months as required. At the end of November 1854, the necessary quantity for the experiment was stored in the field in heaps or pits, as before described. They were of the best "golden yellow" variety, of a deep orange colour; and in point of quality may be classed next to the Swedish turnip. On the 28th January 1855, I had eight cattle, coming two years old, crosses between the Aberdeen and short-horned breeds, selected for the experiment. They were weighed on the steelyard, and divided into two lots, as nearly equal in weight and quality as the circumstances would permit. One lot was then tied up on the stored turnips, and the other on the same kind of turnips pulled and drawn from the field, load by load, as the cattle consumed them, all clear of tops and tails. The stored turnips were also brought from the field, as required, in the same manner. The feeding-byre was roomy and well ventilated, and contained four double stalls, two for each lot, so that the animals were kept perfectly separate, and enjoyed the same freedom, comfort, and air—the byre being, as nearly as possible, kept at a temperature of 48° Fahr. Both lots of cattle received equal quantities of turnips daily, nearly as many as they could eat, with oat straw *ad libitum*, for a period of eighty-four days, when it was found they had consumed 28½ tons of turnips, or an average of 95 lb. per day to each beast. From the 20th October till they were tied up, both lots of cattle were fed in loose sheds, four and four together, on headed turnips and straw; the first six weeks on white globes, and the rest of the time on golden yellows. I might have tied them up earlier, but certain circumstances prevented this. Up to the time the experiment commenced, the weather happened to be soft and fresh; and in that case, and at that season of the year, it is likely that little difference would have arisen in feeding on turnips from the stores or from the field. The experiment, however, just began with the bad weather, and continued through two months of very severe frost and snow, and a month of dry windy spring weather, both of which were surely well suited for testing the effects of stored turnips. A reference to the following Table will show the result of the experiment, and strongly indicate that the period of trial was quite long enough for the unfortunate animals that were fed from the fields from day to day.

TABLE showing the Results of Four Cattle fed on Stored Turnips, and the same number fed on Turnips drawn from the Field as required, during a period of eighty-four days.

Lots.	No.	Description of Turnips.	Weight on 28th January.	Weight on 25th February.	Weight on 25th March.	Weight on 22d April.	Increase of weight during the experiment.	Increase of weight on each lot in experiment.
			cwt. qrs. lb.	cwt. qrs. lb.	cwt. qrs. lb.	cwt. qrs. lb.	cwt. qrs. lb.	cwt. qrs. lb.
I.	1.	Fed on turnips stored in November, . .	8 0 0	8 0 14	8 1 14	8 3 14	0 3 14	
	2.		8 2 0	8 2 21	8 3 0	9 0 14	0 2 14	
	3.		8 0 14	8 1 21	8 3 0	8 3 21	0 3 7	
	4.		9 2 0	9 2 7	9 3 14	10 0 14	0 2 14	2 3 21
II.	1.	Fed on turnips pulled as required, . .	9 0 0	9 0 7	9 1 14	9 2 14	0 2 14	
	2.		7 2 14	7 2 21	7 3 7	7 3 21	0 1 7	
	3.		9 2 7	9 2 0	9 3 7	10 0 14	0 2 7	
	4.		8 0 0	8 0 14	8 1 0	8 1 14	0 1 14	1 3 14
			Balance in favour of stored turnips, ...					1 0 7

The cattle were always weighed at the same hour of the day, and immediately before being fed, at 1 o'clock P.M. The turnips were grown on good sharp black soil, chiefly with farmyard dung, and yielded nearly 20 tons of bulbs per acre, fresh and free from disease. It may be expected that the animals would have increased more in weight in three months' time, but it must be remembered that young growing cattle do not gain weight in the same ratio as they do size. The above table gives results sufficiently favourable to prove the propriety of turnip-storing, showing an increase of animal weight of four young cattle, in the space of three months, of 119 lb. in favour of the stored turnips. Besides this, the healthy appearance of the cattle in lot No. I. presented a striking contrast to those of No. II., being sleek and fresh in their coats, and better down in the bellies; whilst No. II. were dry in their coats and lanky in appearance. Altogether there was a marked difference of appearance between the two lots, such as a stranger acquainted with cattle would easily perceive on entering the door of the feeding-byre; and I believed lot No. II. to be farther back than the difference of weight indicated. By the damage done to the unstored turnips, in pulling them from under the snow, and the mischief by vermin, &c., lot No. II. had 1 ton more turnips, wasted and destroyed, in order to supply them with the same quantity as given to No. I., being equal to the produce of 8 poles of land, or one-twentieth part of an acre, which, at £7 per acre, would be an item of 7s.—fully adequate to store three-fourths of an acre of turnips.

Thirdly, *General remarks on the advantages of storing.*—The facts already brought out are strong proofs that the storing of turnips has many advantages to recommend it, and must be very important to every farmer; but there are other advantages connected with the system which cannot be so clearly developed, but nevertheless of considerable consequence. When turnips are stored in autumn, they can generally be carted to the homestead with comparative comfort; and as the land is then pretty firm and dry, the work can be carried on with ease and speed;—a saving of labour is thereby effected, compared to drawing them in rainy weather. By drawing turnips in winter as required, the land, which at that time is often very wet, must be injured by the puddling of horses and carts, and the exposure of the manure to the action of the weather. Should the soil happen to be at all adhesive, the puddled places, when again dry, get soured, and caked into a hard state, and are thus very difficult to reduce to a proper mould: the succeeding grain crop is commonly deficient, and loss must thereby be sustained. In drawing turnips from day to day, the operations of the farm are very much impeded; the perpetual shifting of men and horses from one job to another—one tool left here, and another there—gives an

awkwardness and detention in the whole routine of farm operations. The less shifting of men and horses, the more work is always done. Each job should be completely finished before another is begun (when weather and other unforeseen circumstances will permit), so that the day-to-day system of drawing turnips is objectionable, for the simple reason that it detains the work. If the plan of turnip-storing were universally adopted, the greatest drawback would be want of hands at the proper time; but if once the system had begun to take its course amongst the other operations of the farm, that difficulty would gradually diminish. If single cottages and gardens for married servants were more generally patronised than they are unfortunately at present, agricultural labourers would be more easily supplied than they now are. The use of grubbers and other improved implements ought to shorten the process of cultivating the land, and thereby give more time in autumn for effectually securing the turnip crop. The economy of turnip-storing has now been pretty freely discussed, less one important part, to which I shall, in conclusion, yet briefly advert. We have it from the best authority "that there is a time for everything under the sun," and it appears to me strange indeed, if the cold, frosty, and sleety days of winter be the proper time for gathering in the turnip crop,—thus making it the worst and most slavery work for men and horses connected with farm labour; and if the profit that would undoubtedly arise from pursuing the system above recommended be not reason sufficient to induce all to forego the old method, perhaps a respect for humanity may operate beneficially with some. This year has been well adapted for showing the utility of stored turnips to the best advantage; yet, in ordinary open seasons, they will amply remunerate the farmer for his labour. I have very frequently stored the whole crop on this farm, before December, in the manner now described, and in no instance had I cause to regret, but, on the contrary, to be pleased with the result. The experiment now made will no doubt tend to strengthen my conviction of the great propriety, nay, even necessity, of adopting this system. I shall only say, that our extensive and valuable fields of turnips ought, like other crops, to be stored at the proper season, and now trust that my experience and suggestions, &c. on the subject, will be borne out advantageously by other practical agriculturists.

REPORT ON THE MEANS EMPLOYED FOR GROWING AND SECURING A SOUND POTATO CROP.

By Mr WILLIAM HOSACK, Dochcarty, Ross-shire.

[Premium—The Gold Medal.]

IN the end of March 1852 I planted 5 acres of York regent, and 4 of Irish cup potatoes,—the seed of the former variety having been grown in Easter Ross, and of the latter in Wester Ross; but each on lighter land than that in which they were planted. In both cases the roots delivered to me had passed through an inch-and-a-half riddle; and after delivery I had them passed over an inch riddle, and all under one inch in diameter were laid aside. From a few of the potatoes two sets were got, but from the greater part only one; and each tuber from which only one set was got, had a few of the eyes cut out, with the view of preventing the growth of too many shoots.

The field in which these potatoes were planted consists of a free, dry loam, and has an open, southern exposure. In the end of 1851 it was broken up with a strong furrow from one year's grass (which had been cut for hay and afterwards pastured). The crop preceding was wheat; and as the land was out of heart by previous heavy cropping, I was induced to try potatoes, whereas otherwise I should have taken oats.

The sets were planted from 10 to 12 inches apart, and ploughed down every third furrow, with Peruvian guano applied at the rate of 3 cwt. per acre in the same furrow as the sets. The whole field was then harrowed and rolled, and left thus till the young plants showed themselves, when I had the earth pared away, and a drill grubber passed between the rows—care being taken not to approach the young plants too closely, either in paring or grubbing. In a few days thereafter they were carefully hand-hoed; the weeds near to the stems of the plants were pulled away with the hand; and when all the weeds were withered, the plants were earthed up with a double-mould plough, and left in that condition till the potatoes were lifted.

The whole crop, but especially the Irish cup potatoes, grew most vigorously, and kept green till towards the end of August, at which time the shaws of the cups were not less than 4 feet high; and while these potatoes were green and healthy, all those planted with dung in the usual manner were blackened and withered away, and the crop was a complete failure. With rare exceptions this was the case, not only on my own farm, but over the district.

The potatoes which were laid down with guano in the manner already stated, were taken up in the second week of October, and put into long narrow heaps—not pits—covered with straw, and just enough of earth to prevent the straw being blown away.

After lying thus for a fortnight, they were hand-picked. Those exceeding one and a half inch in diameter were laid aside for sale; those again from that size down to one inch in diameter were separated for seed; and all the smaller, diseased, and broken roots were given to the pigs.

In the end of October the potatoes were stored for the winter, by being laid on the surface of a piece of ground lying to the south, in long heaps 3½ feet at the base by about 2 feet high. The heaps, till within 6 inches of the ridge, were covered with wheat-straw, over which was laid a thick coating of earth. The ridges were thatched with drawn straw, the ends of the thatch being brought over the earth already laid on, and a small quantity of mould, carefully smoothed down, being placed above them to retain the thatch in its place. The ridge was thus left open for ventilation, while it was at the same time perfectly water-tight. In the end of December a slight covering of horse-dung was spread over the heaps, which completely preserved the potatoes from frost.

The bulk of the regent potatoes was delivered in the end of November 1852, and of the cup potatoes in the beginning of March 1853; but a considerable proportion of both kinds was left as stored till towards the end of March. In each ton delivered, whether in November or March, there was not a peck of diseased roots, and this was the case also with those laid aside for seed.

Both varieties were all along treated alike, and the yield was as follows:—

	Ton. cwt. qr.	Ton. cwt. qr.
1st, York regent potatoes—Gross per acre, .		3 11 0
Of this quantity there were, of potatoes exceeding 1½ inch in diameter, .	2 13 0	
Of potatoes from 1 to 1½ inch in diameter,	0 14 0	
Of small, broken, and diseased, .	0 4 0	
		3 11 0
2d, Irish cup potatoes—Gross per acre, .		4 5 0
Of this quantity there were, of potatoes exceeding 1½ inch in diameter, .	2 18 2	
Of potatoes from 1 to 1½ inch in diameter,	1 1 2	
Of small, broken, and diseased, .	0 5 0	
		4 5 0

The money value being:—

	Ton. cwt. qr.		
York regents, .	2 13 0	at 80s. per ton, .	£10 12 0
Do. do., .	0 14 0	at 60s. „ .	2 2 0
			£12 14 0

	Ton. cwt. qr.		
Irish cups, .	2 18 2	at 63s. per ton, .	£9 4 3
Do. do., .	1 1 2	at 60s. „ .	3 4 6
			£12 8 9

I would not, at the present date, have reported on the result of this crop, were it not that, from the comparative success I met with in it, I was induced, in the following year, to try whether or not I could grow potatoes after a white crop with guano alone. The return, as compared with that I had from a fair application of dung, was so satisfactory, that in spring 1854 I planted a considerable extent of the fallow break with regent potatoes, allowing from 4½ to 5 cwt. Peruvian guano to the acre in the drill. I at the same time laid down some acres of the same variety with ordinary court manure, applied in the drill, at the time of planting, at the rate of 18 to 20 cart-loads an acre. So remarkable was the difference in the crop in favour of guano, that I had the ground measured, and found that, in round numbers, there were six tons an acre of sound potatoes after guano, and only three after dung. The field on which these potatoes were grown was in good heart, and under oats in 1853, grass pastured in 1852, wheat in 1851, and turnips, well laid down and ate off by sheep, in 1850; and that part in which the potatoes were grown with guano got no dung from 1850 till after the potatoes were lifted. It consists of a good dry loam lying on a steep incline, and the oat stubble got a strong furrow down the hill only in the end of the year.

I have taken the liberty of referring thus generally to the crop grown by me in 1854, as, although I had not two varieties tested by being treated alike, the result shows very clearly the important advantage to be derived from growing potatoes with guano, and gives me greater confidence in submitting this report on my crop in 1852 for approval.

REPORT OF IMPROVEMENTS ON THE ESTATE OF ARCAN, IN THE COUNTY OF ROSS.

By Mr John Mitchell, Factor to the Hon. Mrs Stewart Mackenzie of Seaforth.

[Premium—The Gold Medal.]

The estate of Arcan was purchased by the late Lord Seaforth about the year 1808, subject to the life-rent of the then Proprietrix, Mrs Mackenzie, who continued to possess it until her death in 1818. The estate then came into the possession of Lord Seaforth's eldest daughter, the Hon. Mrs Stewart Mackenzie, the present Proprietrix; but it was burdened with a life-rent of part of the Mains farm, held by a man who died in spring of 1852, at the age of 104 years.

According to a survey made in 1802, it contained in all 912 imperial acres, whereof 268½ were arable, 504½ pasture and bog lands, and 139 waste and wood lands. In 1817, and in 1840,

surveys were made of the low-lying part of the estate on the south bank of the Conon, known as the Bog of Arcan, with a view to its reclamation. Again, in 1847, a new survey was made of the entire estate, showing an extent of 974 imperial acres, as follows: 321½ acres arable, 632 pasture and bog land, and 20½ wood and waste land. Plans and sections for embanking the bog land were at the same time drawn out, the levels taken, and the line of a main drain and embankment marked off. Matters stood in this position, when, in the beginning of 1850, the Reporter was intrusted with the management of the Seaforth estates by the Hon. Mrs Stewart Mackenzie.

The estate, although separated from Brahan by the river Conon, lies almost wholly in view from the windows of Brahan Castle; and its improvement was an object which Mrs Stewart Mackenzie was most anxious to accomplish. The greater part of the leases were to expire at Whitsunday, 1852, and the Reporter was specially instructed to keep in view the improvement of the whole estate in making arrangements for new leases, which was accordingly done in the following manner:—

On the upper or south part of the estate, divided from the other parts by a road and stone fences, there was a farm of 81½ acres arable, with rough pasture on the banks of the river Orrin, where a wood had some time previously been cut down. There were also two crofters holding about 15 acres in cultivation, with a right to pasture on a part of the ground from which the wood had been removed. This part of the property it was resolved to throw into one farm; and a lease was granted to the tenant of the 81½ acres, wherein it was stipulated that new farm-buildings should be erected, and about 80 acres of the pasture-land brought into cultivation; so that, with the land occupied by the crofters, the farm should extend to about 180 acres. The farm-steading has been erected, with a water-power threshing-machine, and a comfortable farm-house built on an adjoining rising ground. Suitable new roads have been constructed, and from 40 to 50 acres of the pasture-land have been improved and cropped. The trenching of the remainder is progressing, and will ere long be under cultivation.

Near the west march there are a number of small crofters and cottars who have not been disturbed. The crofters occupy at small rents, and a few of the older cottars hold gratuitously. The services of those people will be very useful on the new farms, as has already been experienced.

Joining these crofts on the north, and on the south of the bog lands, but separated from the latter by the district road, is a square piece of land which was also occupied by crofters. It contained 43 acres arable, and 42 acres pasture. The arable was interspersed with heaps of stones, and it and the pasture were blended together

in irregular patches. These 85 acres it was resolved to put into one farm; and an agreement for a lease of nineteen years was entered into with the principal crofter, who became bound to drain, fence, and bring into cultivation the whole land, and also provide the necessary houses. The drainage has been effected, and what required trenching has undergone that operation; and in the course of a year or two the whole will be cultivated.

In order to provide for four of the more industrious crofters whom it was found necessary to remove from their holdings in carrying out the intended improvements on the two before-mentioned farms, four lots of ten acres each, partly moor and partly bog land, were set apart for them. They are situated to the north of the last-mentioned farm, and between the district road already noticed and the main drain running through the bog. Agreements on nineteen-years' leases were entered into with them, providing for the building of houses, improving and fencing the land, and for having it all cultivated within the first four years of the leases. Houses have been built, and the greater part of the land is now cultivated, and producing fair crops.

Another farm, of about 110 acres arable, was out of lease in 1851. It was intended to have this farm in connection with the Mains and bog land when reclaimed, both because it would be useful in maintaining the stock while the improvements of the bog were proceeding, and because, from its situation, one new steading could be erected, with a water-power threshing-machine, which would be sufficient for all the lands thus united into one farm. The tenant of these 110 acres held possession until 1853, when it was joined to the Mains and bog lands.

The Bog of Arcan is a flat piece of swampy land, extending along the south bank of the Conon for about a mile and a-half from the march, with Fairburn at the west, to where the Orrin falls into the Conon at the east, and averaging about 30 chains in breadth. The soil is a deposit of the Conon: its surface is elevated above the river, at the ordinary summer-level, from three to eight feet. In times of flood, however, a large portion of the land was overflowed; and in winter and spring floods, particularly when snow was melting on the higher grounds, the waters of the Conon frequently covered its entire extent. During a flood in 1849, the water was several feet deep in the highest part of the lands. The extent subject to be thus inundated was about 350 acres. In 1851, 40 acres of the higher land were in cultivation, but the remaining 310 acres were partly covered over with alder, thorn, juniper, and other rough bushes, and partly with stagnant pools, of several acres in extent, in various places; while other parts were so wet that, even in the middle of summer, they could not be passed over but by leaping from one bush to another: altogether, the place had a most unsightly appearance. The only

purposes which it served in this natural state was the grazing of small Highland cattle and horses, and the breeding of wild duck, with which it abounded. The grazing was let to the crofters in the neighbourhood in three different lots, at a gross rental of about £60. In 1851, as a preliminary step towards the reclamation of this swamp, a main drain was made, having its outlet into the river at the lowest part of the ground. This drain, which cuts through the bog from west to east, is 4 feet wide at bottom, with a slope of 1½ to 1 on the sides. It was cut during that summer, and by the end of autumn it was obvious that, if the river could be kept within its banks, the reclamation and profitable cultivation of the bog was attainable.

Early in 1852 plans and specifications were provided for an embankment, the line of its site decided on, and the work advertised to be contracted for by estimate. Seven offers were made for its execution, varying in amount from £885 to £2600, but the work was finally let to Mr John Sime, Inverness, than whom there are few so well qualified for such an undertaking, at a gross sum of £1200.

He commenced operations on the 6th day of May. The sluices were set, and the work completed by the 20th of August; the undertaking thus occupying only three months and two weeks. The length of the embankment is 3132 yards; its average height is 8 feet. The river-side slope is 2½ feet horizontal to 1 foot perpendicular; and the land-side slope is 1½ to 1; but for 450 yards, at a turn in the river, where it was necessary to give the embankment extra strength, the river-side slope is 3 to 1, and the land-side slope 2 to 1. The line of embankment was placed so as to leave sufficient earth for its formation betwixt itself and the river; and this earth was so taken away as to leave a slope towards the river of not less than 5 to 1, and leaving a scarcement or benching of 6 feet wide between the base of the bank and the top of the slope to the river. The whole of the embankment was carried up in layers of 9 inches in thickness, and each successive layer firmly packed with wooden beaters. The surface of slopes was, when regulated, covered with turf not less than 10 inches by 12 inches, and 4 inches thick, compactly laid together with proper band, and firmly beaten home, both on the edge and surface, with flat wooden mallets.

The embankment contains three self-acting metal sluices, fixed on the outlet mouth of wooden conduits, which convey the water under the bank into the river. The sluice at the outlet of the main drain is 2½ feet square, and has a conduit of like size, made of larch plank, 3 inches thick. In order to continue the line of the main drain, and give the stream an inclination downwards into the river, this wooden pipe or conduit passes through the embankment at an angle of about 45°; and, owing to the height and consequent breadth of the bank at this lowest part of the ground,

the length of the conduit extends to 120 feet. Another sluice, with conduit 18 inches square, is placed near the upper end of the embankment, in a low part of the ground, serving as an outlet of the drainage of about 100 acres of the western part of the lands. It also conveys to the river a stream coming from the neighbouring high grounds during wet weather, which is carried across the main drain at a higher level, to relieve that drain of a considerable quantity of water which it would otherwise have to discharge. The third sluice, and conduit 16 inches square, are at the eastern extremity, and serve as an outlet for the drainage of that portion of the lands.

An essential part of the agreement with the contractor was, the protection of the natural bank of the Conon at two points, where the river was cutting very deeply, and yearly washing away large slices of the finest of the land. The length to be protected at these two places was 770 yards, and before the contract was entered into much consideration was given as to the most effectual means of preventing the farther encroachments of the river at these two points. It was ultimately resolved to protect their entire length with a slope of stones: although this was an expensive plan, yet it was believed that it would prove efficient. An additional reason for adopting it was, that there were large heaps of stones on the centre farm, at a distance of about a mile, which were entirely suited for the purpose, and the removal of which would greatly aid in the improvement of that farm.

The natural bank of the river, at 2 yards from the base of the embankment, was accordingly sloped to the level of ordinary floods, at the rate of 3½ feet horizontal to 1 foot perpendicular, and covered with strong turf in the same way as the embankment itself. Downwards into the bed of the river the ground was either sloped, or made up of such materials as could be had, to have a slope of 3 to 1. The river along the 770 yards is deep, in one place measuring from 15 to 20 feet perpendicular depth; the average may be stated at from 8 to 10 feet at the summer level of the river. On the slope of 3 to 1, the stones from the farm above mentioned were laid down, and regulated to the depth of not less than 18 inches at an average for about 15 feet wide of a slope; thus requiring many thousand loads to complete the work. The contractor's estimate for this protection was £145; but, in order to make it sufficient, £47 additional were allowed, making in all £192. This part of the work has proved most satisfactory, as it has not required a single repair since its execution up to the present time. The same may be said of the entire work; for, although the river has several times been so high as to reach to within 3 or 4 feet of the top of the embankment, no outlay has been required for its repair, and the only expense incurred is a sum of something under £5 for the repair of a few cuttings, made by the ice, in the natural

bank in the spring of this year. So efficient have the sluices and embankments proved that, during some of the highest spring floods, ploughing was carried on within the embankment, when the water in the river was as high as the horses' bridles. The only drawback to the undertaking is, that during a continuance of wet weather in winter, when the river remains high for perhaps ten days or a fortnight, the water inside accumulates so as to cover a few acres of the lowest of the land. This disadvantage, however, can easily be remedied by the erecting of a small steam-engine, to pump the water over the bank on such occasions, and thus keep the whole dry for the preservation of a wheat or turnip crop on the very lowest of the lands.

At the upper end of the new embankment, but on the estate of Fairburn, the river was cutting in the same manner as at the two places for the protection of which stones were used, but to a smaller extent than at either of those places. In order to prevent an encroachment of the river here, which might have ruined the whole work, this part was similarly protected, and an old embankment on the Fairburn lands, to which the new embankment was joined, was strengthened and raised 18 inches higher, for a distance of 850 yards upwards, as parts of the Arcan improvement. These two works cost the sum of £85, 17s. 8d.

Again, at the eastern extremity of the lands, a considerable outlay was required. The river Conon runs nearly level along the length of the embankment, the fall from the upper to the lower end not exceeding 2 feet, the fall on the embankment being 21 inches. The Orrin river, which joins the Conon at the east end of the embankment, is a rapid mountain stream, which passes in its course through several high banks of gravel, which it carries down with it during floods. Part of these stones and gravel so carried down is deposited at the junction of the Orrin with the Conon, impeding the course of the latter river, and causing the bed of the Orrin gradually to move upwards, so that its stream, when these works were commenced, was running into the Conon at about right angles. It was also endangering the opposite bank, which had been some years previously protected by piling, to prevent damage to the pleasure grounds of Brahan Castle. To remedy these evils as far as possible, the stones which had been deposited in the Conon were taken out and placed on a slope on the Brahan side, and the bed of the conjoined rivers was thus lowered about 12 inches. The channel of the Orrin, near its junction with the Conon, was filled up with stones taken out of the beach, and a new channel made, so as to give the stream an inclination downwards into the Conon at a small angle, causing the two streams, when united, to act on the gravel brought down, so as to keep the channel of the two rivers from being further obstructed. This new channel for the Orrin was strengthened on the Conon side by a sloping embankment of

the largest stones found on the beach. These works have satisfactorily answered the purpose for which they were intended. Their cost was £145, 5s. 7d.

The main drain, as has been already mentioned, having been made in 1851, several sub-main and small drains had to be made, to complete the drainage of the lands, and these were marked off and let to a contractor in the spring of 1852. The rooting of the bushes and levelling of the ground was let at the same time. A part of the land was ploughed, and about 80 acres sown with oats, and harrowed in by the beginning of May. By the spring of 1853 all the drainage had been executed, the bushes rooted out, and removed or burned, the ground levelled, and all ploughed, excepting about 50 acres of the roughest and lowest parts. The cost of these various works was as follows:—

I.—Drainage.

Main drain, 1997 yards, at 1s. 3d.,	£124 16 3	
Cost of conveying water of open ditch from high lands, over main drain at west march,	2 14 10	
Outfall open ditch, conveying water from bog, and upland water, by upper sluice into river, depth 3 to 5 feet, breadth at bottom 4 feet, sides sloped 1 to 1, 179 rods of 5½ yards each, at 2s. 0¾d.,	18 10 6	
Minor drain, similar to above, 18$\frac{10}{11}$th rods, at 1s. 4½d.,	1 6 0	
Outfall open ditch from Arcan Mains, same as above, but deeper at upper end, 182 rods, at 2s. 3½d.,	20 17 1	
Making small drains of wood through the low and wet parts of the bog, at 1d. per yard,	44 13 5	
Amount for drainage,		£212 18 1

II.—Embankment and Protection, &c.

Contract price for embankment and protection,	£1200 0 0	
Allowance for extra work at protection,	47 0 0	
Three wooden boxes, for conduits and metal sluices,	24 11 3	
Work at upper end of embankment on Fairburn,	85 17 8	
Works at confluence of rivers Conon and Orrin,	154 5 7	
Amount for above works,		£1511 14 6

III.—Rooting, Clearing of Bushes, and Levelling.

Rooting out stumps and bushes, and levelling 135¼ acres, at 40s.,	£271 5 3	
Do. Do. Do., 123½ acres, at 20s.,	123 10 0	
Carting off large roots and burning bushes,	45 10 7	
Amount for above,		£440 5 10
(A large portion of the bushes and roots was carted off by the neighbouring population for fuel, which has made this item in the expense much less than it would otherwise have been.)		
Plans and sections for embankments, and incidental expenses for the whole works,		35 5 7
Making total permanent outlay,		£2200 4 0

Being a cost of £6, 5s. 8d. per acre over the 350 acres benefited, or at 6¼ per cent interest on the expenditure, making a rent of

8s. 2d. per acre. But the former value of the place for grazing being about £60, a rental of 3s. 5d. an acre comes to be added, which makes a total rent of 11s. 7d. to repay the outlay.

The following is an account of the results of the improvement, so far as already realised:—

I.—Crop 1852.

In the spring of 1852, as previously stated, 80 acres of the bog land were ploughed, and sown with oats.

The cost of first ploughing was 20s. per acre,	£80 0 0	
The harrowing, being difficult, at 4s. 6d. per acre,	18 0 0	
Seed for 80 acres, at 6 bushels per acre, and 60 quarters at 20s. per acre,	60 0 0	
Harvesting and disposing of crop at 12s. per acre,	48 0 0	
Expense of crop 1852,		£206 0 0
Returns.		
233½ quarters oats, at 18s. per quarter,	£210 3 0	
Straw of do. at 5s. per quarter,	58 7 6	
		268 10 6
Showing a profit, on crop 1852, of		£62 10 6

II.—Crop 1853.

65 acres turnip land, ploughed in summer of 1852, at 20s. per acre, cross ploughing in 1853, at 10s. per acre, harrowings at 4s. per acre, drilling and sowing turnips, 6s. = 40s.,	£130 0 0	
Turnip seed, hoeing and drill-harrowing, 6s.,	19 10 0	
Guano for 65 acres, at 3 cwt. per acre, 30s., and bones, 6 bushels, 18s.; together, 48s. per acre,	156 0 0	
Expense of turnip crop,		£305 10 0
(The land was limed, but as this crop derived no benefit from it, the price is not charged against it.)		
The turnips were partly consumed by cattle, and partly by sheep, and paid at the rate of £4 per acre,	£260 0 0	260 0 0
Deficiency on this crop,		£45 10 0
150 acres oats, for ploughing 80 acres, second furrow, at 10s., and 70 acres, first furrow, at 20s.,	£110 0 0	
Seed, at 6 bushels an acre, 112 quarters, at 20s.,	112 10 0	
Harrowing and sowing do., at 4s. per acre,	30 0 0	
Harvesting, and disposing of crop, at 12s. per acre,	90 0 0	
Expense of grain crop,		£342 10 0
Produce of 150 acres, 349 quarters oats, at 22s.,	£283 18 0	
Straw of do., at 5s. per quarter,	85 0 0	
Value of crop of oats,		468 18 0
Profit on crop of oats,		£126 8 0
Deduct deficiency on turnip crop,		45 10 0
Nett profit on crop 1853,		£70 18 0

These two crops of 1852 and 1853 do little more than pay the cost of first ploughing, and expenses of cultivation and harvesting; but it must be observed that, for these two years, the soil was only being brought into cultivation for the first time, and the land was

in a very rough and open state, with clods and roots; and that what was chiefly looked for was the pulverising of the ground rather than a large crop.

III.—Crop 1854.

Before proceeding to detail the expenses and returns of crop 1854, it will be proper to state the arrangements that had been made with regard to it.

The adjacent farm of 110 acres had now been united to the Mains of Arcan and Bog-lands, making an extent altogether of upwards of 400 acres. For the cultivation of this extent of land the existing houses were quite inadequate, and being old and useless, a new steading was indispensable. In 1853, barns and a stable were accordingly erected, and a threshing-mill, propelled by water, was built. The old houses served for byres for feeding cattle, and temporary sheds were made for lean stock. During last summer the building of the other parts of the steading was continued, and is now all but completed. The steading is designed with every convenience which will be required in carrying on the cultivation of the farm for which it is erected, and its value will not be under £1500.

Of the 350 acres benefited by the embankment, 40 acres lying betwixt district road and main drain were allotted to four crofters, as already noticed. The remaining 310 acres were, in 1854, occupied as follows:—

I.—Grain Crops.

165 acres oats, for ploughing, harrowing, and sowing, at 10s. 6d. per acre,	£86 12 6	
18 acres do. for do., very rough, 25s.,	22 10 0	
20 do. barley and wheat, for do., at 10s.,	10 0 0	
Amount for ploughing,		£119 2 6
Seed for 183 acres, 120 qrs. oats, at 25s.,	£150 0 0	
Do. 8 „ 4 „ wheat, at 70s.,	14 0 0	
Do. 12 „ 8 „ barley, at 35s.,	14 0 0	
Amount for seed,		178 0 0
Guano used on rough and poor spots, 2 tons,	£20 0 0	
Harvesting, threshing, and disposing of 203 acres, at 15s. per acre,	152 5 0	
Amount for harvesting, &c.,		172 5 0
Total expenses of grain crop,		£469 7 6

Estimated probable returns.

45 acres oats after turnips, 30 stacks, 10 qrs. each—300 qrs. at 28s. (7 qrs. per acre nearly),	£420 0 0	
120 acres second crop of oats, 36 stacks, 12 qrs. each—432 qrs. at 28s.,	604 16 0	
8 acres wheat, 4 stacks at 10 qrs. each—40 qrs. at 60s.,	120 0 0	
12 acres barley, 6 stacks at 10 qrs. each—60 qrs. at 30s.,	90 0 0	
Straw of 832 qrs. at 5s. per qr.,	208 0 0	
Value of grain crop,		1442 16 0
Nett value or profit on grain crop,		£973 9 6

II.—Green Crops.

72 acres turnips, potatoes, and tares, for ploughing, harrowings, drilling, hoeing, and cleaning, at 40s. an acre,	£144 0 0	
Guano, at 3 cwt. per acre—72 acres—10 tons, 16 cwt., at £11, ...	118 16 0	
Bone manure for 52 acres turnips, at 6 bush.—312 bush. at 3s. 6d., ...	54 12 0	
Turnip seed, £6; potato seed, £46; tares, £8, .	60 0 0	
Expenses of green crops, . .		£377 8 0

Estimated Returns.

22½ acres turnips have been let for sheep at £5, .	£112 10 0	
22½ do. not so good, do. £2, 10s.,	56 5 0	
7 do. to be consumed by cattle on farm, at £5, 10s., ...	38 10 0	
15 acres potatoes only produced 20 tons, owing to disease, at 60s., ...	60 0 0	
5 acres tares for horses, at £4, ...	20 0 0	
Value of green crops, . . .		287 5 0
Deficiency on green crops, . .		90 3 0
The nett produce of grain and green crops is, . . .		883. 6 6
The pasture of 25 acres not yet cultivated, may be stated at 20s. an acre, ...	£25 0 0	
From the embankment £8 worth of grass has been sold, and about a like quantity made into hay—say, in all,	15 0 0	
Value of natural grass, . . .		40 0 0
Haking the nett proceeds for crop 1854,* .		923 6 6
From which deduct original rent-charge for permanent improvements, at 11s. 7d. per acre, ...		179 10 10
Balance in favour of improvement for crop 1854, . . .		£743 15 8

In conclusion, a retrospect of the entire estate may not be uninteresting.

In 1850 it was divided into three farms and twenty crofts, besides the bog pasture. The nominal gross rental was £332, 16s. 10d. For reasons which it is not necessary here to explain, the rental actually received only amounted to £270, 12s. 3d.; and, besides this, there was a large amount of old arrears outstanding. In 1853 the estate was composed of three farms and thirteen crofters, besides cottars. Taking the lands under improvement in the hands of the proprietor at the previous rents, the gross rental was £359, 19s. With one exception—an improving crofter—this rental has been regularly paid, and no arrears are now on the estate.

The improvements on the farms under lease and upon the crofts have been chiefly effected by arrangements with the tenants, with little outlay on the part of the proprietor; and the foregoing statement as to the lands in her own hands will show that there is every prospect of the heavy outlay required being repaid long before the expiry of the existing leases in 1871. At that time there will be

* The estimated net proceeds of crop 1854 have been fully realised.—J. M.

at least 750 arable acres, and 224 acres pasture, or rather woodland—as all that is not adapted for cultivation is to be planted.

Taking the arable at the low rent of 25s. an acre, the rental would be, ...	£937 10 0
And say, for 224 acres woodland, at 5s., . . .	56 0 0
Making in all, ...	£993 10 0

Or nearly four times the actual rent paid in 1850.

Besides these pecuniary advantages which will accrue if the improvements are carried out, as they well may be, the climate of the district has been ameliorated by the drainage of so large a tract of bog land; the additional employment which has been and will be given to the population is considerable; the increased produce of the estate, so far as it goes, is a new source of wealth to the country; and, finally, the appearance of the district is greatly improved—as, from Brahan Castle, and various points of the grounds in the vicinity, the fine Highland prospect which presents itself is no longer marred by the swampy morass which occupied its foreground.

REPORT OF EXPERIMENT IN THICK AND THIN SOWING OF OATS.

By Mr Alexander Bowie, Mains of Kelly, Forfarshire.

I have long had the impression that farmers generally over-seeded their land, and although for some years back I have to an extent acted upon this impression, yet I have never, until last year, put it fairly, and I hope accurately, to the test by experiment. The first thing that attracted my notice many years ago, and which led to my present views on thin-sowing, was a field of oats, so seriously cut up after brairding by grub-worm, &c., that I contemplated the necessity of ploughing it up, and sowing it with turnips. My faith, however, in thinness, although not so strong at that period as now, was yet sufficiently firm to allow the field to remain as it was, and take its chance; and although it appeared miserable in the extreme, and ten times thinner than I could venture to sow, yet the crop—certainly somewhat later, and the grain a little lighter—was a remarkable one under the circumstances, being rather above 11 bolls (of 6 imp. bushels) per Scotch acre. The result of the above grub-thinned field—which might be termed a hint from nature—induced me to reduce my barley seed the following year to 4 against 5 bushels; the result being so obviously in favour of 4 as to be noticed by the least observant in the harvest field, the ear being larger, the straw longer, and of

greater strength, and the gross bulk decidedly greater. I may here mention that at this period I applied 8 bushels of oats, 5 of barley, and 5 of wheat, as the ordinary allowance of seed to a Scotch acre, quantities which are even yet sown by some in this county. My present practice (after the presser) now is 4 to 5 of oats, 3 to 3¼ of barley, and 2½ to 3 bushels of wheat—this last being increased to 3½ or 4 bushels, if winter sown, or any extreme casualty of the season requiring it.

Many reflections now occurred to me, such as the following: Why should our cereals not require air and space to grow in as well as any other plant? Why be so particular in the distance between our potato sets, singling our turnips, &c., to a given distance between the plants, and giving them 30 inches between the drills? Why does a blanky crop of Swedes often prove the heaviest? Or, above all, why should 3 bushels of barley per acre grow a very heavy crop, and the same quantity of oats not do the same, seeing there are very many more grains in a bushel of the latter than the former? Examine a field of oats sown after the old manner,—assuming that the blade has had from four to six weeks' growth, while to the passer-by it has a goodly and vigorous appearance, to me it gives the idea of a vegetable battle-field; multitudes of tillered, half-tillered, and single plants are seen huddled and packed together in masses, and fighting for existence, the close observer noticing that already the weak are beginning to give way to the strong; and if he observes to the end, many plants disappear altogether, and others come up half length with two or three corns at the top. I am not botanist enough to know exactly when and how the ear is formed; but I am satisfied that its size, if not its health, is determined at an early stage; and that it will be diminished in size, if not in health, if the plants by over-seeding are so huddled and packed together as mentioned above. Having formed these ideas, I next considered how a small quantity of seed oats might be applied to the soil regularly and at equal depths, so as to secure a uniform braird of all the seed sown; and considering the irregularity and want of firmness in the seed-furrow of lea for oats, I thought of the *presser*, which many years ago, I had read somewhere, had been used by Mr Watson of Keillor and others with good effect upon easy soils, and which might combine almost the property of the drill with the benefit of an equal consolidation of the seed-furrow;—my experience of this implement, after five or six years' trial, being decidedly in favour of its use upon easy and light soils, if accompanied with thin sowing; but if with thick, I consider it an evil. The present experiment (see annexed Tables) was undertaken with a view to ascertain the benefits of thin-sowing of oats in pressed drills, the seed being by the use of the presser all covered in, and at equal depths, with a uniform firmness of seed-bed.

In part of a field of brown loamy land, mostly incumbent on gravel, intended to be sown with potato oats, and only in very middling condition, I selected 12 rigs of the most equal naturally good soil, and divided it into 4 lots of 3 rigs each; I then had Mr M'Beth, a notedly correct land-measurer, who in the most careful manner not only measured each lot, but every rig by itself, in order that greater accuracy might be obtained in distributing the seed, which was weighed out to each lot and rig. They were sown on the 27th March, the ground being very dry. Lot No. 1 was sown at the rate of 6 bushels, No. 2 with 5, No. 3 with 4, and No. 4 with 3 bushels per Scotch acre. (I have chosen Scotch measure, as being most familiar to Scotch farmers.)

The annexed Table shows the mode and results of this experiment in thick and thin sowing, giving a large balance both of straw and corn in favour of the thin.

There is a very general opinion that thin-sowing is only applicable to rich land. The result of this trial is not in favour of this idea, as the soil experimented on was rather in poor than rich condition; and I am inclined to think that the multiplication of plants in a poor soil is rather an evil than a good, because it has not strength to mature them. Moreover, I am disposed to think that over-seeding rich rather than poor land is the least of two evils: this idea, however, is, I believe, so completely contrary to general opinion, that it might very properly be made the subject of experiment.

Although the summer of 1854, on the whole, proved dry, yet experience has shown us that it was singularly fine for the proper maturation of all the cereals. As might have been expected in the progress of the growth of each lot, No. 1, or the thickest sown, took the lead, and looked best for a time, but shortly assumed a light green colour, while its enemy, No. 4, or the thinnest sown, gradually progressed, and retained a healthy dark green colour, and, contrary to my expectation, ripened as soon, and when cut was quite as free of greens as the other, which last circumstance I decidedly attribute to the use of the presser, the seed having all brairded at same time, having been sown at equal depths, and which certainly would not have been the case, the ground being so dry, had that implement not been used. The whole were cut down on the 30th August. I should have mentioned before this that each of the lots received 2 cwt. dissolved bones, sown into the pressed drills along with the seed, but I could not perceive the slightest influence of this special manure over the rest of the field that received none. Here I would notice another benefit derivable from the presser. Special manures, now so generally given to cereal crops, are brought in closer contact with the seed, and better covered in from the drought.

Had I thought of it in time, this trial might have been made

useful in extending it to an unpressed lot, thereby testing the use of the presser on similar easy soils, as I by no means consider extreme thin-sowing a safe proceeding without either the use of the drill or presser. Another circumstance observed I must not omit to state: the two thinnest-sown lots were first ready to stack. From the greater strength of the straw, they were easier winnowed in the stook, and would have kept better in the stack, supposing each only in middling condition when carried; and this certainly is a matter of some importance in a wet season—the conclusion being, that a crop, although apparently backward at first, may be the first ready to carry to safety.

On the whole, therefore, this experiment indicates in a decided manner the loss both in straw and corn by over-seeding; and from the close approximation in yield of lots 3 and 4 (or the thinnest sown), I infer that 3 bushels per Scotch acre sown by drill, or after presser, is about touching the lowest safe point in the thin-sowing of oats.

TABLE

A TABULAR VIEW of the Method adopted for Sowing Equally, and for ascertaining the advantages of Thin over Thick Sowing, the Presser having previously been applied to the land.										RESULTS of Experiment in Thick and Thin Sowing on the Farm of Mains of Kelly, by Arbroath, in 1854.						
No.	Area.			At rate sown per Scotch ac.	Quantity sown per Lot.				Quantity sown per Rig.	Yield per Scotch acre.		Yield in bolls of 6 imperial bushels.		Yield of Straw per Scotch acre.		
Lots.	Acres.	Roods.	Falls.	Bushels.	Bushels.	Pecks.				Bushels.	Weight.	Bolls.	Bushels.	Cwts.	Qrs.	Lb.
1	...	3	23	6	5	$1\frac{1}{2}$	Rigs.	3	$7\frac{1}{6}$ Pecks.	$53\frac{1}{2}$	$42\frac{3}{4}$	8	$5\frac{1}{2}$	35	1	8
								2	$7\frac{1}{6}$ "							
								1	$7\frac{1}{6}$ "							
2	...	3	23	5	4	2	Rigs.	3	6 Pecks.	$58\frac{3}{4}$	43	9	$4\frac{3}{4}$	38	1	21
								2	6 "							
								1	6 "							
3	...	3	21	4	3	2	Rigs.	3	$4\frac{4}{6}$ Pecks.	$66\frac{1}{4}$	$43\frac{1}{4}$	11	$0\frac{1}{4}$	45	1	12
								2	$4\frac{4}{6}$ "							
								1	$4\frac{4}{6}$ "							
4	...	3	24	3	2	3	Rigs.	3	$3\frac{4}{6}$ Pecks.	$66\frac{3}{4}$	$42\frac{3}{4}$	11	$0\frac{3}{4}$	47	2	10
								2	$3\frac{4}{6}$ "							
								1	$3\frac{4}{6}$ "							

Increase of straw per Scotch acre in No. 4 over No. 1 = 98 imperial stones at 4d., ...	£1 12 8
Do. corn do. do. No. 4 over No. 1 = $1\frac{5\frac{1}{4}}{8}$ quarters, at £1, 10s., ...	2 9 8
Saved in seed, do. do. No. 4 over No. 1 = $0\frac{3}{8}$ quarters, at £1, 10s., ...	0 11 3
	£4 13 7

PROCEEDINGS IN THE LABORATORY.

By Professor ANDERSON, M.D., Chemist to the Society.

I. ON THE COMPOSITION OF NATURAL WATERS EMPLOYED FOR DOMESTIC PURPOSES.

FEW subjects are a source of so much perplexity to the chemist as the determination of the value of a water for domestic purposes, for simple as the problem at first sight appears, it embraces a great number of difficult points in regard to which we are still much in the dark, although of late a good deal has been done in the way of placing our knowledge on a firmer basis, and clearing up some obscure questions. It is a familiar fact that no terrestrial water is pure, even rain water not being absolutely free from foreign matters, but containing a minute quantity of ammonia and organic matter. These impurities, which it acquires during its passage through the air, are necessarily present in excessively minute proportion; but no sooner does the water reach the earth's surface, than it obtains from the soil and from the rocks through which it percolates a variable proportion of inorganic and organic substances. Both the quantity and the nature of the ingredients which it thus obtains are dependent on the geological nature of the surface on which it falls, and accordingly we find that in different districts the composition of the waters of springs, wells, and rivers, is very different—so much so, that we may sometimes ascertain, from the examination of the waters, the passage from one geological formation to another with as much certainty as if we looked to the rocks themselves.

Generally speaking, the constituents of a natural water consist chiefly of salts of lime, magnesia, potash, and soda, with carbonic and sulphuric acids, and chlorine, together with occasionally small quantities of phosphoric and other acids, in too small quantity, however, to have any practical importance. The quantity of these substances contained in water is very variable, being in some instances as low as 2 grains per gallon, while in others it rises as high as 20, 30, 40, 50, 100, and more grains. The lower the proportion of these substances the better is the water adapted for most purposes, but there is no upper limit beyond which it can be considered *absolutely* unserviceable. The general composition of a water may be most readily explained by selecting an individual example; and I give, therefore, as a fair illustration, the following analysis of a water from the neighbourhood of Dunse. The numbers, as is always the case in the analysis of waters, represent in grains the quantities of the different constituents in a gallon of water.

Carbonate of lime,	12.71
Sulphate of lime,	1.63
Carbonate of magnesia,	0.22
Chloride of sodium,	2.05
Chloride of potassium,	1.34
Sulphate of potash,	2.46
Peroxide of iron and alumina,	0.30
Silica,	0.55
Organic matter,	5.54
	28.80
Deposit on boiling,	16.60
Remaining in solution after boiling,	10.20

The most abundant constituent in this case is carbonate of lime, the presence of which, however, calls for some observation. It is a familiar fact that carbonate of lime is insoluble, or nearly so, in water, although it dissolves in a solution of carbonic acid; and as all natural waters have absorbed from the air or from the soil through which they percolate a certain quantity of that gas, they acquire the property of dissolving that substance to a greater or less extent. In the individual example before us, the 12.71 grains of carbonate of lime, which are stated to exist in a gallon of the water, have been thus held in solution, and over and above the constituents mentioned in the analysis, there must have been present a quantity of carbonic acid sufficient for this purpose, and in a very elaborate analysis of a water this quantity ought to be determined; but as the method of doing so is complex and troublesome, and its proportion is practically unimportant, it is always omitted except in the case of mineral waters. The carbonic acid which thus acts on the solution of carbonate of lime is retained by a very feeble affinity, and it suffices to boil the water for some time to have it completely expelled, and by consequence to cause the precipitation of the carbonate of lime which it held in solution. Along with it are precipitated all the carbonate of magnesia which may be present, and small quantities of iron and organic matter. In the case under consideration the total quantity of these substances deposited by boiling amounted to 16.60 grains per gallon. The deposit so formed adheres to the interior of the vessel, and hence waters which contain much lime in the form of carbonate have a great practical disadvantage when they are to be employed in steam-boilers, because a crust, often of considerable thickness, is soon formed in the bottom of the boiler, which acts prejudicially both by preventing the heat reaching the water, and by causing the bottom of the boiler to be rapidly burned. The quantity of this deposit is therefore a matter of much importance in estimating the value of a water, and the smaller it is the better (*cœteris paribus*) will that water be.

But lime salts generally, whether carbonate or sulphate, are injurious to the water in another way, for they confer upon it that

quality which we call hardness. A hard water, then, may be defined as a water containing a large quantity of lime salts, and the mode in which they act in deteriorating its quality is extremely simple, and may be best rendered intelligible by reference to a very familiar fact. Every one who has had occasion to use a very hard water must have observed that it is difficult to make it form a lather with soap, but that in place of it white flocks are produced, which float in the form of a sort of fur on the surface. These flocks are formed by the soap and the lime salts mutually decomposing one another. Soap is a compound of soda with certain fatty acids, of which margaric acid is the most abundant, and, on coming in contact with a salt of lime—the sulphate, for example—the sulphuric acid combines with the soda, forming sulphate of soda, while the margaric acid unites with the lime, forming an insoluble compound. As this insoluble substance has no detergent properties, soap must be added to the water as long as it precipitates with the lime salts, and it is only after that has taken place that a further addition enables us to wash with it. There is thus a waste of soap, which, independent of the inconvenience attending the use of such water, is a source of very considerable annual loss; and though it is impossible to ascertain what proportion it bears to the total quantity of soap consumed, it is probably far from inconsiderable. Alkaline and magnesian salts have also their disadvantages, though, as their quantity is smaller, they are of less importance.

These facts lead to the manifest conclusion that the smaller the quantity of carbonate and other salts of lime it contains, the greater is the applicability of a water to domestic purposes. In other words, the purer a water the better it must be. But this conclusion, though strictly true in the abstract, is limited in practice by the particular nature of the action of water upon the cisterns used to contain it. The material most commonly employed for this purpose is lead, and in point of practical convenience and facility of working it surpasses every other metal, but it possesses the very remarkable peculiarity of being acted on by pure water. If a piece of lead be put into pure distilled water, only a few minutes elapse before we see a whitish film appear upon its surface, and bright white crystalline scales make their appearance floating through it, and gradually depositing in a film, which in the course of four-and-twenty hours completely covers the bottom of the vessel. If the clear fluid be drawn off, it is found to contain lead in solution in very appreciable quantity. What is thus seen in distilled water is also observed in terrestrial waters of the purer sorts, but in this instance we have a material difference, according to the nature of the salts in solution. In some cases the deposit is little less abundant than it would be with distilled water, and part of the lead exists in solution, and in others the whole is deposited

in the form of a white powder, and the clear fluid contains no lead. The injurious effects of lead upon the system, and serious consequences which have frequently resulted from the use of waters containing a comparatively small quantity of that metal, are sufficiently well known, and the result has been that great fear exists on the part of the public lest the water they employ should contain it. A distinct statement of the conditions under which it is found may therefore be of some use in placing the matter in its true light. It is unnecessary to observe, that when the water contains abundance of salts, it is invariably without action upon lead. Although the smallest quantity in which they must be present in order to produce their protective effect is not accurately known, and indeed varies with the proportion in which the salts exist in it, this much, however, may be said, that the absence of organic matter is important, as the decompositions which it is liable to undergo have a very marked effect in promoting the action upon lead. In general, 5 or 6 grains of solid matters per gallon are sufficient to render a water incapable of acting on lead to any material extent. When we descend below this, and particularly when we come to the very pure waters which flow from mountain springs in granitic districts, we find that the action upon a piece of lead in a glass vessel is very powerful, the metal being quickly corroded, and a deposit formed. Such water we should at first sight be inclined to condemn as totally inapplicable to domestic purposes, and under particular circumstances it undoubtedly is so; but an extensive series of experiments made on waters from all parts of Scotland and England has convinced me that, without injurious consequences, they may be safely employed.

In illustration of this point, it is necessary for me to point out that the experiment usually made for estimating the action of a water on lead, by introducing a few square inches of the metal in thin sheet into 3 or 4 ounces of water, often leads to results very different from those observed in practice. Of this no more striking instance exists than that presented by the water of Loch Ness. When experimented on in the manner just mentioned, nothing can be more striking than the rapidity of its action on lead. Within ten minutes after the introduction of the metal, white scales are seen floating through it, and in twenty-four hours the bottom of the glass is completely covered. Judging from this experiment, it would be pronounced in the highest degree unsafe to convey the water of Loch Ness through leaden pipes, or to preserve it in cisterns of that metal. Yet the town of Inverness has for the last twenty years been supplied in this way, without the slightest bad effect, and no lead colic, nor any of the other symptoms produced by the passage of that metal into the system, have ever been observed. The absence of these symptoms be-

comes at once intelligible when it is stated that the water drawn from the lead cisterns, in which it has remained for several days, is found to contain no lead, nor are the cisterns in the least degree corroded. In short, the experiment on the small scale gives no indications of what is to be obtained in practice, the conditions in the two cases being materially different. It is not that the water after it has been carried to Inverness has lost the power of acting upon lead, for the water drawn from the taps in the town acts with as much energy as ever on a slip of lead; it is really dependent upon the difference in the conditions under which the experiments are made. Nor is that of Loch Ness an isolated case. The towns of Whitehaven, Sheffield, Heywood, Chorley, and Bolton, are all supplied with water which acts powerfully upon lead when the experiment is made in the manner already indicated; but no bad effects have been observed, and symptoms of lead poisoning are as rare in these towns as in those supplied with the hardest water. It is impossible to explain the cause of the very different results obtained in practice and by experiment upon the small scale; but I have ascertained that when the lead has acquired a dull coating by exposure to the air, or still better, to hard water, it ceases to be acted upon on the small scale, and that, even in pure waters which act on lead with great rapidity at first, a permanent coating is formed on the surface of the metal after a time, and then all action ceases.

Many other remarkable facts in relation to the action of waters on lead have been observed, to enter upon the discussion of which would lead me into great details. Enough has been said, however, to show that no case has occurred in which the wholesale poisoning of the inhabitants of a town has occurred, even although they have been supplied with waters which act powerfully on lead. But it is very different on the small scale, for numerous instances are on record where the inhabitants of country houses have suffered from violent symptoms, which have been distinctly traced to the presence of lead in the water. On what this difference depends I am not prepared to give an opinion, no case of this description having fallen under my own notice; and in those which have been published, the analysis of the water having generally been confined to the detection of the lead, we have no means of ascertaining whether there was any peculiarity in its composition. I am inclined, however, to attribute it to the presence of organic matter; and I am strongly of opinion that waters containing it in large quantity should be carefully avoided. It is worthy of remark, also, that a very small quantity of lead will produce a considerable effect if the water containing it be used for some time; but the quantity has a decided limit; and it appears that when it does not exceed one-tenth of a grain per gallon, the water may be employed without bad consequences. The water used in the town of Aberdeen contains very nearly that quantity.

While I am of opinion, from the facts I have observed, that the risk of lead entering into the water of large towns has been much exaggerated, I conceive that it would be hazardous to introduce into a country town water which showed any disposition to act upon lead; for though it might not be attended with any evil consequences, still there is not the same certainty of perfect uniformity in its composition of the water at different towns existing in the large sources from which large towns are supplied; and from its lying for a longer time in the cisterns the risk of contamination is much increased.

Of course, when a water acts on lead, recourse can always be had to pipes and cisterns of other materials, among which galvanised iron is probably the best; but with all those substances practical disadvantages are connected, and it is preferable to obtain a water which can be safely preserved in lead.

In the preceding observations I have confined myself to the points affecting the domestic uses of water. The agricultural uses for irrigating, &c., are also important, but into this point I cannot at present enter, but shall probably do so at a future period.

II. ON THE COMPOSITION OF HEMP-SEED.

In addition to the staple articles employed for feeding cattle, we occasionally met with others which are used by individuals, either from some facilities which they possess for obtaining them, or for the purpose of ascertaining by experiment whether they deserve to be introduced into common use. In the course of my connection with the Highland Society, I have had occasion to analyse many such substances, some of which have proved of value, while others, as might be anticipated, have not fulfilled the expectations which had been formed regarding them. To the former category hemp-seed belongs. I have been unable to obtain any information as to the extent to which it has been employed for feeding purposes; but I apprehend that, in this country at least, its use has been extremely limited. Mr Telfer of Cunning Park has used it experimentally, and having consulted me as to its feeding value, I was unable to find any analysis, except an old one by Bucholz, on which much reliance cannot be placed, as it was made at a time when the methods of conducting such analyses were extremely imperfect. He found it to contain—

Oil,	19.1
Husk,	38.3
Woody fibre and starch,	5.0
Mucilage,	9.0
Sugar,	1.6
Albuminous matters,	24.7
Fatty matters,	1.6
	99.3

In this analysis, obviously made according to old and imperfect methods, it is probable that the only constituent in the determination of which any confidence is to be placed is the oil, and even that differs very greatly from the quantity found in my analysis. The sample I analysed was part of that used by Mr Telfer. It gave—

Water,	6.47
Oil,	31.84
Albuminous matters,	22.60
Ash,	6.37
Fibre, mucilage, &c.,	32.72
	100.00
Nitrogen,	3.56

The ash contained—

Phosphates,	2.47
Phosphoric acid combined with alkalies,	0.76

Comparing this with Bucholz's analysis, we find that the quantity of oil exceeds by more than a half that which he found, and the only individual constituent which approaches his determination is that of the albuminous compounds—an approximation from which, however, no conclusions ought to be drawn, as it can only be fortuitous, in so far as chemists at that time had no accurate method of determining their proportion.

As far as the nutritive value of the hemp-seed is concerned, it may be most correctly deduced by a comparison of this analysis with that of linseed, which must always form the standard of comparison for all the oily seeds. To facilitate this comparison, I give here an analysis of linseed, and also one of linseed-cake—

	Linseed.	Oilcake.
Water,	7.50	12.44
Oil,	34.00	12.79
Albuminous matters,	24.44	27.70
Ash,	3.33	6.12
Fibre, mucilage, &c.,	30.73	40.95
	100.00	100.00
Nitrogen,	3.85	4.33

The ash contained—

Phosphates,	2.03	2.73
Phosphoric acid combined with the alkalies,	0.12	0.55

It is obvious from these results that no very material difference exists between linseed and hemp-seed. The latter, no doubt, is somewhat inferior, but a very small difference in price would suffice to cover that of value. As compared with oilcake, however, the choice must manifestly depend upon whether a food rich in oil or in albuminous matters be required. If the former, then hemp-seed is to be preferred. I shall not venture to discuss the question as to whether oil or albuminous matter is the more important

nutritive constituent of a food—a question which can be decided only by experiments on cattle; but it is clear that wherever linseed is preferred, hemp-seed may be used with equal success. It might, therefore, be used with advantage in feeding calves—a purpose to which a considerable quantity of linseed is at present applied in some parts of the country; and its price being moderate, it deserves the attention of farmers. Mr Telfer speaks very favourably of the results obtained in his hands, and the analysis leads to similar conclusions.

III. OBSERVATIONS ON PEAT-ASH, AND THE CONNECTION BETWEEN THE COMPOSITION OF THE ASH AND THE INFERTILITY OF SOME PEAT SOILS.

The employment of peat-ash as a manure has long been familiar to practical men; and in Holland, where it has been most extensively used, the results obtained are said to be excellent, and the quantity annually consumed is very considerable. Attempts have at different times been made to introduce the Dutch peat-ash into this country, but without success; and I believe that in most instances where it was employed no effects were obtained, and in a few cases only could it be said to have produced any decided improvement in the crop. Some difficulty exists in explaining the difference in the results obtained in the two countries, but it appears to be mainly due to two circumstances. Of these the first, and probably the most important, is the different nature of the soils to which it has been applied. In the majority of instances it would appear that the good effects produced by peat-ashes have been most marked on heavy clay soils, and there is little doubt that it has been due much less to the ashes supplying to it those substances required for the food of the plants growing upon it, than to the mechanical action produced by it, when added in considerable quantity, in reducing the excessive tenacity of such soils. Indeed, we have only to examine the published analyses to see that the effect produced must be explained in this or some similar manner, because the quantity of the important nutritive constituents of plants present in it is generally very small, and quite insufficient to influence to any extent the growth of the crop. Taking phosphoric acid as an illustration, it appears that the largest quantity found by Sprengel in Dutch turf ash was 2 per cent, and in an excellent peat examined by myself, the carefully-prepared ash contained only 1.6 per cent,* so that we may reasonably assume 1.5 per cent as a high average for that element. But 1 ton of peat-ash would be considered a fair, and 2 tons per acre a very large application; and when we calculate the quantity of phosphoric acid, and find that it amounts to no more than 33 lb. in a ton, it becomes at once obvious that the quantity, even in the largest application,

* Highland Society's *Transactions*, New Series, vol. iv. p. 558.

is quite inconsiderable, when compared with that in the soil itself, which may be taken in round numbers at 1 ton per acre. The same observations apply with equal force to all the other constituents, with the exception, indeed, of sulphate of lime (gypsum), which frequently forms a considerable proportion of its weight, in some instances as much as 12 or 14 per cent, but it is a comparatively unimportant constituent of a manure for general crops. It is useful, however, as a manure for clover, and it is only on that crop that peat-ashes, in this country at least, have been found to produce any effect.

The other reason for the failure, so often experienced in this country, is the extremely variable nature of the ashes imported. Sprengel long since showed that the quality of the ashes used in Holland was very variable; and the subjoined analysis, which was made with great care, and on a sample stated to be of high quality, and for which, I believe, a considerable price was asked, will show that in some instances phosphoric acid is almost entirely absent—

Peroxide of iron,	5.33
Alumina,	2.98
Lime,	11.75
Magnesia,	4.57
Potash,	1.49
Soda,	1.17
Chloride of sodium,	1.50
Phosphoric acid,	traces
Sulphuric acid,	9.77
Carbonic acid,	2.68
Sand,	25.36
Silica,	9.86
Charcoal,	6.17
Water,	17.37
	100.00

It cannot be doubted that peat-ash of this composition are not likely to be of much value for general manurial purposes. The quantity of sulphuric acid and lime present may make it useful where clover is to be grown, but the same purpose would be better and more cheaply effected by a comparatively small dressing of gypsum. The whole system of agriculture employed in this country appears to me to be quite incompatible with the employment of such substances as peat-ash as a manure, for where high farming is practised, it is clear that the aim of the farmer must be to obtain a large supply of such substances as the plant receives in smallest quantity from ordinary soils. Gypsum (sulphate of lime) is no doubt far from being abundant in our ordinary soils, but if we direct attention to the constituents of that substance, we see that one of these, lime, is invariably present in the soil, and that too in considerable quantity, and it is only for the sulphuric acid that we employ gypsum. Now when we consider that two of the most commonly employed special manures—namely, sulphate of

ammonia and dissolved bones—contain that acid in very large quantity, we shall readily understand that when they are used, the supply of sulphuric acid contained in the soil must be perfectly sufficient for all the requirements of the plant, and the failure of that manure in this country is readily intelligible. I have entered into these details because attempts have at different times been made to bring peat-ashes under the notice of farmers in this country, and the effects obtained in Holland and elsewhere have been insisted upon as an inducement to use them. It is obvious from the observations now made, that there is little prospect of success where the land is in a high state of cultivation, as it is in this country, and it seems probable that, just in proportion as the use of portable manures extends in Holland, peat-ash will prove less serviceable in that country.

But in addition to those cases in which the ash of peat is of little manurial value, there are cases in which the infertility of peat soil is clearly traceable to the composition of its ash. A remarkable instance of this came under my notice lately. A peat soil at Achanrigh had been reclaimed, but particular portions of the field proved completely bare, and nothing showed any tendency to grow upon them. The peat at these places was burned, and the ash ploughed in, and the result was, that some improvement took place, although these portions of the field were still very bad. A portion of the charred peat was sent to me for analysis, and the result gave—

Potash,	0.74
Soda,	0.99
Magnesia,	0.40
Lime,	1.18
Protoxide and Peroxide of iron,	30.72
Sulphuric acid,	5.52
Sand,	42.74
Charcoal,	17.68
	100.00

In this case the composition of the ash is manifestly entirely different from that usually met with, and of which the previous analysis may be taken as a tolerably fair illustration. It will be understood, of course, that the charcoal is due to imperfect combustion, and the large quantity of sand to the fact that the peat had become mixed with some of the subsoil. The most remarkable feature in its composition is the small quantity of lime and the great abundance of oxides of iron, which form nearly one-third of the whole mass of the ash as analysed. A considerable quantity of this ash is in the state of protoxide, and its presence along with a considerable quantity of sulphuric acid is a sufficient indication that the peat in its natural condition must have contained a large quantity of sulphuret of iron. This sulphuret, during the burning of the peat, has been oxidised, a part of its sulphur driven off, and the rest converted into sulphuric acid, the iron having been at the

same time converted partly into protoxide and partly into peroxide, the quantity of air not having been sufficiently large to bring it entirely into the latter condition. Now these facts are sufficient to account in the most satisfactory manner for the infertility of this peat, for nothing is more thoroughly established than that sulphuret and protoxide of iron are highly injurious to vegetation, and act, in fact, as a positive poison to plants. I am not aware that sulphuret of iron and protoxide of iron have before been found in such abundance in peat, but they are certainly far from being unusual constituents in smaller quantity; and abundant evidence of this fact is afforded by the water which flows from a peat bog, which generally has a dark brown colour, and often deposits an ochrey substance in considerable quantity. This substance, as I have ascertained on several different occasions, is the salt called the apocrenate of the peroxide of iron, and is an indication of the iron having originally existed in a state of protoxide. The apocrenate of the protoxide of iron being soluble, is readily washed out of the peat, and by exposure to the air is converted into the insoluble salt of the peroxide. The deposition of this substance must therefore be always taken as an indication that protoxide of iron exists in a peat or in a soil, and consequently as a proof that it contains a substance prejudicial to vegetation. Of course, it is not to be imagined that, for this reason, the peat or other soil in which it occurs is to be condemned, for the quantity of protoxide of iron may be very small, and too inconsiderable to produce a material effect; but it ought to be taken as a hint to employ those means by which such injurious substances can be got rid of, a subject in regard to which I shall have a few words to say. Still less is it to be supposed that the infertility of a peat soil is always to be attributed to this cause. On the contrary, we know that in many instances it is the superabundance of vegetable matter in a state in which it is little inclined to undergo further decomposition, and yield the ammonia and carbonic acid required for the nutriment of the plants which are to grow upon it, which is the true cause of its supporting vegetable life so imperfectly. But it is far from improbable that the presence of salts of protoxide of iron in peat may be a more common cause of infertility of such soils than has been commonly supposed, and it is very certain that the decompositions which are always proceeding in a peat soil are such as to bring the iron contained in it into the state of protoxide or of sulphuret. The vegetable matter existing in a soil is constantly undergoing a process of oxidation, during which carbonic acid is produced and escapes, while the residual portion of the organic matter passes into the state of one or other of those substances which have been grouped together under the somewhat vague name of humus. Now, in the event of the access of air to the pores of the peat being sufficiently free, its oxygen is directly absorbed; but if it is excluded, either through the pores having been

saturated by water or from any other cause, the vegetable matter takes oxygen from any substance existing in the peat, and capable of readily parting with it. No substance does so more readily than peroxide of iron, and under these circumstances it is rapidly reduced to the state of protoxide. If sulphuric acid be also present, and the circumstances be favourable, the decomposition goes further, and it as well as the oxides of iron give up the whole of their oxygen to the vegetable matter, and the sulphur and iron, uniting, form the sulphuret of iron—of all others the compound from which the most injurious effects are to be expected.

The conditions under which the iron is reduced, and the sulphuret formed, have been very clearly made out, and they afford us satisfactory indications of the mode in which it is to be got rid of. The most obvious mode of effecting this is by burning, which immediately converts iron into peroxide, and sulphur into sulphuric acid; and no method is more effectual when it can be employed; but the cases in which it can be made use of with complete success are comparatively rare. In the case already referred to this is strikingly illustrated, for the iron, which must originally have been in the state of sulphuret, is only partially converted into peroxide; a part remaining is protoxide, and hence we have the explanation of the partial success which had attended the process. More effectual in practice, though more slow in its operation, is the adoption of some method of more freely admitting the air into the pores of the soil; and hence we find that when such peat soils are drained, the removal of the water lays open the pores, and oxidation of the iron takes place with rapidity. The addition of lime further hastens this effect, because it liberates the protoxide of iron from any combination in which it may exist—a very important matter, as we know that, so long as it is combined with any other substance, it resists oxidation. Unless these conditions are attended to, the improvement of peat land cannot be successfully carried out, but the extent to which they are necessary differs greatly in different localities. Thus, for instance, the peat from Renfrewshire, of which an analysis appears in the fourth volume of the *Transactions*, yields excellent crops of potatoes with very little preparation, and in it the proportion of iron is comparatively small. I may add here another analysis of a peat-ash from Dalmahoy, in which that metal is also small, but containing so large a proportion of silica that it does not differ materially in composition from a fertile soil—

Silica,	81.61
Peroxide of iron,	12.54
Alumina,	1.85
Lime,	1.31
Potash,	0.46
Chloride of sodium,	0.13
Phosphoric acid,	traces
Sulphuric acid,	2.02
	99.92

The cause of its similarity to a common soil was at once rendered obvious by an examination of the air-dried peat, which gave—

Water,	15.22
Vegetable matter,	49.44
Ash,	35.34
	100.00

It is obvious that only a small part of this ash could have belonged to the organic matter, and that by far the larger proportion must have been earthy matter mixed with it. We find, indeed, as might be expected, that in deposits of peat the earthy matter is frequently very abundant, and even in deep peat-bogs individual strata contain large quantities of earthy matter; and this no doubt is one of the reasons why commercial peat-ash is so extremely variable in its quality.

RETURNS OF SEED COMPETITIONS held in 1855.

Districts.	Seed exhibited in Competition. Names of Species and Varieties.	Quantity. Qrs.	Number of Competitors.	Award. L.	Award. s.	Competitors to whom Silver Medals were adjudged. Christian and Surname.	Estate or Farm, and Post-Town.	Produce per Imperial Acre. Qrs.	Weight per Bushel. Lb.	Date of Sowing.	Date of Reaping.	Ground on which the Prize Seed was grown. Altitude. Feet.	Exposure.	Nature of Soil.
Haddington.	April Wheat,...........	10	2	2	0	George Rate,......	Lampockwells, Pencaitland,.	3½	64¼	1st wk. Ap.1854	2d. wk. Sep.1854	about 300	S.	Clay.
	Chevalier Barley,........	10	7	2	0	T. S. Mitchell-Innes	of Phantassie, Prestonkirk,..	7	59¾	April 25, 1854	Sept. 4, 1854	30	N.	Gravel.
	Potato Oats,............	10	8	2	0	James Brodie,.....	Linplum, Haddington,.....	8	46½	Last week Mar.	Middle Sep. —	570	S. W.	Rich clay, well drained.
	Late Angus Oats,........	10	3	2	0	George Rate,......	Lampockwells,............	7½	43¼	Sec. week —	Third week Sep.	about 300	E.	Clay.
	Hopetoun Oats,..........	10	5	2	0	Robert Howden,..	Boggs, Pencaitland,........	8	44	Middle —	About end Aug.	fully 300	S.	Thin clay.
	Oats, approved variety (Sandy),............	10	4	2	0	Jas. Maitland Balfour,......	of Whittingham, Prestonkirk	6½	44½	March 16, 1854	Sept. 5, 1854	350	S.	Clayey mould, on red sandstone.
	Beans (field),............	10	3	2	0	J. Maitland Balfour	of Whittingham, Prestonkirk	5	67	March 15, —	Sept. 20, —	300	N.	Clayey loam.
Buchan.	Early Berlie Oats,......	3	20	2	15	John Hutchison,...	Monyruy, Peterhead,......	6	45½	March 10, 1854	Sept. 1, 1854	80	N.	Yellow loam.
	Perennial Rye-grass Seed,	2	4	2	0	John Logan,......	Lunderton, Peterhead,.....	1¾	23		July 20, —	20	N.	Clay.
Banff.	Sandy Oats,............	3	13	2	0	J. C. Grant Duff,..	of Eden, Banff,............	5¼	45¼	March 25, 1854	Aug. 24, 1854	200	N. W.	Light black soil.
	Chevalier Barley,........	3	4	2	0	Alexander Morison,	of Bognie, Turriff,.........	4½	58½	March 8, —	Aug. 29, —	220	S.	Black loam soil.
	Norwegian Barley,.......	3	5	2	0	J. C. Grant Duff, .	of Eden, Banff,............	6	59½	March 9, —	Aug. 21, —	200	N. W.	Deep rich sandy soil.
	Perennial Rye-grass,.....	2	4	2	0	J. C. Grant Duff,	of Eden, Banff,............	1⅞	24	April, —	July 10, —	200	N. W.	Clay soil.
Nairn.	Grey Angus Oats,........	3	3	2	0	William Clark,....	Easter Brightmony, Nairn,	6⅜	46⅕	March 15, 1854	Aug. 28, 1854	200	Northern.	A strong red mortar.
	Common Barley,.........	3	3	2	0	John Clark,.......	Blackhills, Nairn,..........	6	$60\frac{3}{16}$	April 8, —	Sept. 16, —	260	Northern.	Mixture of black loam and clay.
Wester Ross.	Norfolk Barley,..........	3	6	2	0	John Mackenzie,..	Kinettas, Strathpeffer,.....	5	58½	May 1, 1854	Sept. 5, 1854	200	S.	Black loam, various.
	Sandy Oats,.............	3	9	2	0	H. Innes Cameron,	Dingwall, ...	5½	44¾	March 22, —	Aug. 26, —	10 to 20	S.	Generally dark-coloured loam.
	Perennial Rye-grass,.....	2	2	2	0	Kenneth Grant,...	Kinellan, Strathpeffer,......	2¼	28	May 1, —	July 20, —	100	S.	Light loam.

REPORT OF IMPROVEMENT OF WASTE LAND.

By Mr Alexander Reid, Overtown of Fetternear, Aberdeenshire.

[Premium—The Medium Gold Medal.]

In the year 1849, the reporter, who had for a considerable number of years been tenant of the farm of Overtown of Fetternear, the property of Colonel Leslie, K.H., took, in addition thereto, a tract of waste land on the same property, called Kethney Brae, containing 52 acres 1 rood 25 poles. This tract had been under wood upwards of seventy years prior to 1848, when it was cut down and cleared off. In this state the land could not have been worth more than two shillings per acre. It was thickly studded with tree roots, which increased not a little the expense of the improvements. It lies at a height of 480 feet above the level of the sea, and has, for the most part, a southerly exposure, with a declivity varying from 1 in 25 in the lower grounds, to 1 in 14 in the higher grounds. The soil in the lower portions is in general a rich yellow clay, with patches of bog and moss; and, on the higher grounds, a sharp brown soil, lying on a subsoil of hard stony clay. The whole is well sheltered, being surrounded by wood of considerable age on all sides except the south. From this account of the nature of the land, it will be seen that the only practicable mode of improving it was by trenching and draining. This the reporter effected by contract, at the cost appearing in the tabular statement subjoined.

The operations were commenced about the beginning of January 1850, and finished in December 1853.

The trenching upon the first three fields (the higher grounds) was 14 inches deep, "bank measure;" and upon the other four fields it was 12 inches, with a close picking of 6 inches deep below. The reporter is now of opinion that the latter mode is preferable, as the old surface is in this case laid not more than 12 inches deep, very convenient for the roots of the crops to extract nourishment from it, and for being afterwards turned up by the plough; and, further, as the loosening of the subsoil by picking allows the water to sink more freely into the drains.

The furrow-drains were all laid off at 30 feet apart, and were cut in all cases 4 feet deep, and 9 inches wide at bottom, and were filled continuously from the upper end with three rows of wedge-shaped stones 8 inches high, their tapering ends placed downwards, and covered with 4 inches of broken stones, small enough to pass through a 3-inch ring—making a depth of 12 inches in all.

The main drains were cut 2 feet wide at bottom, and generally 4 or 4½ feet deep, with eyes 7 inches wide by 9 inches high in the clear, and covered with stones split for the purpose, and blinded with 3-inch broken stones—making 16 inches deep in all. The

stones, which were principally granite, were had without cartage in sufficient quantity in the trenched land.

The division-fences consisted of double stone dykes 4½ feet high, 3 feet wide at the base, and 16 inches at the top, with projecting copings. The tabular statement shows only the bare expense of building, the cartage of the materials being included in the item "clearing of trenched land," the stones being laid along the lines of the fences at the time.

The ring-fences, which are for the most part sunk dykes, with water-runs at the bottom, were executed at the proprietor's expense, in terms of the reporter's bargain with him, that he (the proprietor) should erect the ring-fences, while the tenant laid in the stones. This accounts for the smallness of the sum for fences in the tabular statement. The expense of the ring-fences is said to have been from £120 to £130, including a road along the west side of the land for accommodation to the surrounding woods, as well as to the different fields lying along its side. Another road has also been made at the reporter's expense, leading from the road last named to the Port-Elphinstone road, and accommodating all the fields. At Port-Elphinstone all kinds of farm produce meet with a ready market, and manures of all kinds are got.

The whole of the improvements were executed according to specifications approved of by the proprietor.

No. I.

No. I.—Tabular Statement of Expense of Improvements.

	TRENCHING AND DRAINING.						FENCING.					DATES.		
No. of Field.	Contents.	Cost of Trenching, including Boring and Blasting. Per Acre.	Cost of Trenching, including Boring and Blasting. Whole.	Length of Drains.	Cost of Drains.	Cost of Trenching and Draining.	Yards of Dykes.	Price per Yard.	Cost of Dyking.	Total Cost of Improvements.	Cost of Improvements per Acre.	Operations Commenced.	Operations Finished.	First Crop.
	ac. ro. po.	£ s.	£ s. d.	Yards.	£ s. d.	£ s. d.	Yards.	d.	£ s. d.	£ s. d.	£ s. d.			
1	8 0 35	8 10	69 17 2	*540	4 6 5	74 3 7	209	4¼	3 14 0¼	77 17 7¼	9 9 6	Jan. 2, 1850.	Mar. 21, 1850.	1850
2	8 0 39	7 15	63 17 9	1400	14 14 0	78 11 9	209	4¼	3 14 0¼	82 5 9¼	9 19 7½	April 9, 1850.	Aug. 20, 1850.	1851
3	8 0 35	8 0	65 15 0	1650	17 6 6	83 1 6	209	4¼	3 14 0¼	86 15 6¼	10 11 2	Feb. 3, 1851.	Sept. 5, 1851.	1852
4	8 1 5	12 0	99 7 6	4174	51 3 0	150 10 6	211	4¼	3 14 8¾	154 5 2¾	18 12 6½	May 28, 1851.	Oct. 21, 1851.	1852
5	5 1 0	13 10	70 17 6	1505	16 10 3	87 7 9	133	4¼	2 7 1¼	89 14 10¼	17 1 10½	Feb. 6, 1852.	Ap. 26, 1852.	1852
6	8 2 16	11 10	98 18 0	4075	49 17 6	148 15 6	218	4¼	3 17 2½	152 12 8½	17 14 11½	Dec. 20, 1852.	July 6, 1853.	1854
7	5 2 15	11 10	64 6 7	1829	26 2 9	90 9 4	143	4¼	2 10 7¾	92 19 11¾	16 12 6	July 6, 1853.	Dec. 1853.	1854
	52 1 25		532 19 6	15,173	180 0 5	712 19 11	1332		23 11 9	736 11 8				

* Fields 1, 2, 3 were drained only so far as found necessary.

No. II.—Tabular Statement of Expenditure and Return on the different Fields per Acre.

Per Acre.	Field No. I. Crop 1850. Oats.		Field No. II. Crop 1851. Oats.		Field No. III. Crop 1852. Oats.		Field No. IV. Crop 1852. Oats.		Field No. V. Crop 1852. Oats.		Field No. VI. Crop 1854. Oats.		Field No. VII. Crop 1854. Oats.	
		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.
Improvements, per Table No. I.		9 9 6		9 19 7		10 11 2		18 12 6		17 1 10		17 15 0		16 12 6
Clearing trenched Land of Stones,		0 12 6		0 12 6		0 12 6		0 12 6		0 18 0		0 12 6		0 10 0
Clearing ditto of Tree-roots, .		0 16 0		0 12 0		0 12 0		0 12 0		0 12 0		0 12 0		0 15 0
Ploughing, ...		0 3 6		0 7 6		0 7 6		0 7 6		0 7 6		0 7 6		0 8 0
Peruvian Guano, . . cwt.	2½ at 10s.	1 5 0	2 at 10s.	1 0 0	3 at 10s.	1 10 0	3 at 10s.	1 10 0	3 at 10s.	1 10 0	2 at 11s.	1 2 0	2½ at 11s.	1 7 6
Cartage and sowing of ditto, .		0 1 0		0 0 10		0 1 3		0 1 3		0 1 3		0 1 0		0 1 3
Seed Oats, . . 6 bush.	at 15s.	0 11 3	at 16s.	0 12 0	at 16s.	0 12 0	at 16s.	0 12 0	at 16s.	0 12 0	at 32s.	1 4 0	at 32s.	1 4 0
Harrowing and Rolling, . .		0 3 6		0 4 0		0 4 0		0 4 0		0 4 0		0 4 6		0 4 6
Previous value of Land, . .		0 2 0		0 2 0		0 2 0		0 2 0		0 2 0		0 2 0		0 2 0
Harvesting and carrying Crop,		0 10 0		0 10 0		0 10 0		0 10 0		0 10 0		0 10 6		0 10 6
		13 14 3		14 0 5		15 2 5		23 3 9		21 18 7		22 11 0		21 15 3
Value of crop, . . .		2 2 6		5 11 6		7 8 5		9 1 1		5 1 0		8 15 0		7 16 3
Land Dr. to Improvements, Carry forward,		11 11 9		8 8 11		7 14 0		14 2 8		16 17 7		13 16 0		13 19 0

No. II.—Tabular Statement—*Continued.*

Per Acre.	Field No. I. Crop 1851. Oats.		Field No. II. Crop 1852. Oats.		Field No. III. Crop 1853. Oats.		Field No. IV. Crop 1853. Oats.		Field No. V. Crop 1853. Oats.		Field No. VI. Crop 1855. Oats.		Field No. VII. Crop 1855. Oats.	
		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.
Brought forward,		11 11 9		8 8 11		7 14 0		14 2 8		16 17 7		13 16 0		13 19 0
Ploughing,		0 10 0		0 7 6		0 7 6		0 7 6		0 7 6		..		..
Peruvian Guano, cwt.	1½ at 10s.	0 15 0		..	2 at 10s.	1 0 0	2 at 10s.	1 0 0	2 at 10s.	1 0 0		..		..
Lime and Carriage, bolls		..	9½ at 4s. 3d.	2 0 6		..		..		..		..		..
Spreading, &c.,		0 0 9		0 2 0		0 1 0		0 1 0		0 1 0		..		..
Seed Oats, 6 bush.	at 16s.	0 12 0	at 16s.	0 12 0	at 17s.	0 12 9	at 17s.	0 12 9	at 17s.	0 12 9		..		..
Harrowing and Rolling,		0 4 0		0 4 0		0 4 0		0 4 0		0 4 0		..		..
Harvesting and carrying Crop,		..*		0 10 0		0 10 0		0 10 0		0 10 0		..		..
Previous value of Land,		0 2 0		0 2 0		0 2 0		0 2 0		0 2 0		..		..
		13 15 6		12 6 11		10 11 3		16 19 11		19 14 10		..		..
Value of Crop,		5 12 0		3 17 8		5 16 9		5 18 4		5 8 7		..		..
Land Dr. to Improvements, Carry forward,		8 3 6		8 9 3		4 14 6		11 1 7		14 6 3		..		..
							Crop 1854.							
Brought forward,		..		..		..		11 1 7		..		..		..
Ploughing,		..		..		..		0 9 6		..		..		..
Peruvian Guano, cwt.		..		..		..	2 at 10s.	1 0 0		..		..		..
Sowing ditto, &c.		..		..		..		0 1 0		..		..		..
Seed Oats, 6 quarters		..		..		..	at 32s.	1 4 0		..		..		..
Harrowing and Rolling,		..		..		..		0 4 6		..		..		.
Harvesting and Carrying,		..		..		..		0 10 6		..		..		..
Land,		..		..		..		0 2 0		..		..		..
		..		..				14 13 1		..		..		..
Crop valued at,		..		..				11 5 0		..		..		..
Land Dr. to Improvements, Carry forward,		..		..		..		3 8 1		..		..		..

* Crop on Field No. I. sold on the ground by public roup.

No. II.—Tabular Statement—*Continued.*

Per Acre.	Field No. I. Crop 1852. Turnips.		Field No. II. Crop 1853. Turnips.		Field No. III. Crop 1854. Turnips.		Field No. IV. Crop 1855. Turnips.		Field No. V. Crop 1854. Turnips.		Field No. VI.		Field No. VII.	
		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.				
Brought forward,		8 3 6		8 9 3		4 14 6		3 8 1		14 6 3		..		..
Ploughing in Autumn,		0 10 0		0 7 6		0 7 6		..		0 10 0		..		..
Labour in Spring,		0 3 6		0 4 0		0 4 0		..		0 4 0		..		..
Drilling twice,		0 10 0		0 10 0		0 10 0		..		0 10 0		..		..
Bones, ... bush.	8 at 3s.	1 4 0	4 at 3s.	0 12 0	5 at 3s.	0 15 0		..	10 at 3s.	1 10 0		..		..
Guano, ... cwt.	1½ at 10s.	0 15 0		..		..		..	1½ at 11s.	0 16 6		..		..
Carriage and Spreading,		0 1 9		0 0 6		0 1 0		..		0 2 0		..		..
Dung, ... loads.		..	17 at 3s. 6d.	2 19 6	16 at 3s. 6d.	2 16 0		..		..		..		..
Carting and Spreading,		..		0 8 0		0 8 0		..		..		..		..
Turnip Seeds and Sowing,		0 1 10		0 1 10		0 1 10		..		1 10 0		..		..
Thinning and Cleaning,		0 7 0		0 7 6		0 7 6		..		0 7 6		..		..
Value of Land,		0 2 0		0 2 0		0 2 0		..		0 2 0		..		..
		11 18 7		14 2 1		10 7 4		..		18 10 1		..		..
Turnips valued at		3 10 0*		7 10 0		6 10 0		..		6 0 0		..		..
Land Dr. to Improvements, Carry forward,		8 8 7		6 12 1		3 17 4		..		12 10 1		..		..

* One-half eaten off by sheep at £2, 10s. per acre, the other half worth £4, 10s.

No. II.—Tabular Statement—*Continued.*

Per Acre.	Field No. I. Crop 1853. Oats.	£ s. d.	Field No. II. Crop 1854. Oats.	£ s. d.	Field No. III. Crop 1855. Oats. £ s. d.	Field No. IV.	Field No. V. Crop 1855. Oats. £ s. d.	Field No. VI.	Field No. VII. .. ..
Brought forward,		8 8 7		6 12 1	3 17 4	..	12 10 1	..	..
Ploughing,		0 7 6		0 8 6	..	..	..	..	..
Lime, . . . bolls.	9½ at 4s.	1 18 0		..	..	..	..	..	..
Spreading ditto,		0 2 0		..	..	..	..	..	..
Seed Oats, . . 6 bush.	at 17s.	0 12 9	at 32s.	1 4 0	..	..	..	..	..
Grass Seeds, . . 1½ bush.	at 5s.	0 7 6	at 4s. 6d.	0 6 9	..	..	..	..	..
Clover Seeds, . . . lb.	4 at 7½d.	0 2 6	5 at 10d.	0 4 2	..	..	..	..	..
Harvesting and Carrying,		0 10 0		0 10 6	..	..	..	..	..
Harrowing and Rolling,		0 4 0		0 4 6	..	..	..	..	..
Value of Land,		0 2 0		0 2 0	..	..	..	..	..
		12 14 10		9 12 6	..	..	..	..	..
Value of Crop per acre,		6 1 8		7 3 9	..	..	..	..	..
Land Dr. to Improvements, Carry forward,		6 13 2		2 8 9	..	..	..	..	..
Per Acre.	Field No. I. Crop 1854. Hay.	£ s. d.	Field No. II. Crop 1855. Hay, &c.	£ s. d.					
Brought forward,		6 13 2		2 8 9	..	..	..	..	..
Value of Hay, &c.,		1 10 0		..	..	..	..	..	..
Land Dr. to Improvements, Carry forward,		5 3 2		..	..	..	..	..	..
	Crop 1855. Pasture.	£ s. d.							
Brought forward,		5 3 2		..	..	..	..	..	..
Value,		..		..	..	..	..	..	..

No. III.—Tabular Statement showing the amount cleared on each Field.

No.	Contents of each Field.			Expenses of Improvement.						Crops taken.	Land Dr. to Improvements.						Amount already Cleared.					
				Per Acre.			Whole.				Per acre.			Whole Field.			Per Acre.			Whole Field.		
	ac.	ro.	po.	£	s.	d.	£	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
1	8	0	35	9	9	6	77	17	7¼	5	5	3	2	42	7	10¾	4	6	4	35	9	8½
2	8	0	39	9	19	7½	82	5	9¼	4	2	8	9	20	1	10½	7	10	10½	62	3	10¾
3	8	0	35	10	11	2	86	15	6¼	3	3	17	4	31	15	7	6	13	10	54	19	11¼
4	8	1	5	18	12	6½	154	5	2¾	3	3	8	1	28	3	9¾	15	4	5½	126	1	5
5	5	1	0	17	1	10½	89	14	10¼	3	12	10	1	65	12	11¼	4	11	9½	24	1	11
6	8	2	16	17	14	11½	152	12	8½	1	13	16	0	115	18	4¾	3	18	11½	36	14	3¾
7	5	2	15	16	12	6	92	19	11¾	1	13	19	0	78	0	7¾	2	13	6	14	19	4
	52	1	25				736	11	8					382	1	1¾				354	10	6¼

From the preceding tables it appears that the sum of £736, 11s. 8d. has been expended on the improvement of 52 acres 1 rood 25 poles of waste land. To this is to be added the expense of making a road, referred to in the report, amounting to £12, 5s. 7d. The value of the ring-fences has not been taken into account, but one-half of the amount (about £60) is fairly chargeable to account of improvements. The whole sum expended, therefore, is about £808, 17s. 3d. Of this, the sum of £354, 10s. 6d. has already been recovered, within five years after the commencement of operations, and after crops, varying from five to one, and averaging three, have been taken on the different fields. No notice has been taken of interest on the outlay. Taking all into account, it will be seen that the land has already yielded an ample remuneration; and, as it is in good condition, an equal return at least may be expected in future.

CONCLUDING REMARKS.

1. It will be observed that the first crop of oats on field No. 1 has been valued at the small sum of £2, 2s. 6d. per acre. The crop of that year (1850) was in general deficient; but the deficiency in this case is chiefly accounted for by the circumstance that, from want of time, the ground was only *grubbered* after the improvements, not regularly ploughed—an error which the reporter took good care afterwards to avoid.

2. The mode of cropping adopted was to take two crops of oats in succession immediately after the improvements. In one case, however, it was necessary to take three crops of oats, in order to have the land in something like regular rotation. The reporter is decidedly of opinion, both from experience and from observation in the surrounding country, that this is the best mode of cropping new land, as it makes the soil to be properly pulverised, and the old surface rotten, before a turnip crop is taken, care being had at the same time to apply appropriate manures to the land. Wherever attempts have been made to take a turnip crop as the first, it has been found to be unprofitable, and of no permanent value to the land.

3. The reporter, who was a contractor for many years previous to his commencing farming on his own account, and had experience of different modes of reclaiming waste land, gives it as his opinion that the best mode is by trenching and draining. This mode brings the land at once into a fit state for cultivation, while any other mode requires several years to effect this, and makes minor improvements constantly necessary.

4. While the trenching operations reported here were going on, the reporter had occasion to observe that the best mode of extract-

ing tree roots was by making use of common levers and pickaxes. Attempts were made by means of machines, but the former method was cheaper, more convenient, *and attended with less danger to the workmen.*

5. The reporter finds that a cross-drain along the top of each field, in connection with the furrow-drains, is of great use in intercepting the water from the higher grounds. He even, after the draining operations were finished, found the same necessary in the middle of two of the fields, where water was observed oozing out in consequence of a sudden fall of the level of the ground.

6. The reporter adopted the mode of filling the drains with stones, as the cheapest and most convenient. It has answered his purpose, the ground being now perfectly dry. He considers it unnecessarily expensive to use pipes when suitable stones can be had on the ground.

REPORT ON RECLAIMING AND MANURING PEAT-MOSS.

By Mr James Cowie, Mains of Haulkerton, Kincardineshire.

[Premium—Gold Medal.]

The most economical and efficient manner of improving peat moss is one of the most difficult, as well as expensive, operations which an agriculturist can undertake. In the case of moor or rough ground of any sort worth improving, he is at most annoyed with surface or set-fast stones, and may have to smooth down uneven surfaces; but there is firm footing for men and horses, and every drain tells and does its duty permanently; and then, if the plough cannot go, the spade can complete the tilling process, and after that the land is as manageable as any hitherto cultivated. In short, the trouble and cost can be counted as near as may be from the first. But with much of the sort of moss which is really an object to improve, the case is very different. It may be so wet and spongy that horses, and hardly men, can go upon it to carry on the first preliminary work of draining; and either the moss may be too deep for effective drainage, or there may not be sufficient fall for the depth of drains required. These and other impediments are best known to those who have had such work in hand; and, after they have been so far overcome, the sequel will reveal, year by year, that here and there a drain which had been carefully put in has given way, and this in many places, and the moss over and about them has got as wet as ever. Nay,

it not unfrequently happens that a thorough re-drainage has become necessary over most of the field. These and other difficulties not enumerated, which we are certain more or less to have to encounter in moss reclaiming, where the natural state of it presents the usual uninviting appearances, are enough to scare us from attempting the work, were we not to start with a predetermination to conquer all difficulties which may present themselves.

It falls to be added, however, in relating this unfavourable contrast at the outset, that, in estimating the comparative facility of improving moor by moss ground, the encouragement and consolation in regard to the latter lie in this, that, while moor ground loses its early flush of productive powers, moss, if dry, adds year by year to its fertilising properties, until it settles down to good, sound arable land.

There are three kinds of moss which are ordinarily to be met with in districts abounding with peat—viz. the common black peat-moss, which is cut and dried for fuel, its distinguishing quality being known among other tests by its red ashes. The second is what is termed flow moss, which carries generally a short stunted plant, intermixed occasionally with short heather, and has a thick rough vegetable skin, and, for a short way underneath, is of a brownish colour, and is wet, and generally deep in the moss. The third is what may be called meadow moss, which is a mixture of alluvial deposit and moss, producing a short natural grass, which is cut, winnowed, and secured for winter provender. It is principally in regard to the second of these soils which it has been the object of the Reporter to inquire into, although he has included the third likewise in his experiments.

Flow moss, lying in its natural state, may be considered the most worthless possible, yielding neither fuel for burning, nor food for sheep; while it presents many of the most perplexing obstacles to improvement with which we have to contend. When the Reporter undertook to reclaim an allotment of about eight or nine acres of this moss, he was not aware of many of these difficulties, but having begun the work, he was impelled to finish it, and for certain reasons he does not now regret he has done so.

Having made these introductory remarks, which may not be considered out of place, the Reporter will now proceed to describe the method adopted by him in reclaiming this moss. It lies in the parish of Kirkcowan and county of Wigtown, and is about 600 feet above the level of the sea, and being surrounded mostly with hills, and unreclaimed morasses, and moors, the climate is rather late, and hoar-frosts are prevalent. Previous to 1851, the summer of which year the improvement of it began, it was of such a wet and sterile nature as to render it unfit for sheep pasture, and not a peat had ever been cast upon it, so that it may be said to

have been wholly useless and unprofitable. It was sounded at various places to ascertain its depth for draining, and was found to be from 7 to 10 feet, which rendered the subsoil beyond reach. It was therefore resolved to put in turf drains in the wedge style, with an occasional intermediate drain filled with pipes placed on a wooden sole. This was adopted to increase the chances of efficient drainage, by one method or the other, or both. The tough surface suited well for forming the wedges; and, being cut to a suitable size, when jammed and trodden in, an open space of about 9 inches high was left for the water to run in. The drains were placed 18 feet apart, but it was not at first decided to what depth they should be cut. They were first tried at 4 feet, and allowed to stand over for a week or two; but, as almost none of them showed any water in the bottom, and the ground continuing as wet as ever, another foot, and in some instances one and a half more, were taken out, which at once produced a remarkable result. From being dry in the bottom before, most of the drains at the second cutting became immediately flooded with water, so much so, that in some of them the men could not work for a few days until the water ran off. In one or two drains 5 feet deep the run was so great that in twenty-four hours' time the ground in the neighbourhood of them sunk down 1 foot, and this not from having been simply what is called a swell, arising from a confined or circumscribed spring, but the case of an ordinary superabundance of moisture without an outlet, a circumstance which may be seen in certain mosses any day. These drains, in cutting and forming the wedge, including the putting of it in, which was done by separate workmen by days' wages, cost about 2s. 3d. the imperial chain. The surface, to the depth of about an inch or a little more, was pared off at an expense of £1 per imperial acre; and the parings were intended to be burned, and spread on the surface; but the weather was not favourable to this process; and besides, the parings being composed of almost pure vegetable matter, there was little or no ash left for top-dressing. The ground was now, about the month of August, ready for the plough, and a sorry ploughing it made. Notwithstanding its apparent dryness, the surface having been removed, and the moss not having had time to consolidate, when the horses' feet trod on it, they went down in many places as if they had been stepping on half-worked clay. This was by far the most tedious and unsatisfactory work of the whole; and it was not only hard labour, accompanied with some risk of overstraining or otherwise injuring the poor animals, but the job was indifferently done, from the impossibility of getting the furrows to lie over. And then, again, in spring the softness of the ground and tough furrow were little changed for the better; hence no mould could be got to cover the seed, a good part of which was left on the sur-

face, except what portion of it got imbedded in rasures made by harrow tines, or fell into crevices, or got concealed under a turf from which the chances were it never would emerge. Six bushels of black Tartarian oats were sown per acre in the end of March, and 2 cwt. of Peruvian guano were added as manure. Except in unfavourable spots, of which many were not wanting where the turf was quite unbroken, there was a tolerable braird considering the bed the seed got; but it made its appearance only to disappoint but too sanguine hopes, and to show that such a soil, still comparatively in its primitive condition, was not congenial to its growth and maturity. It accordingly went almost entirely off in a few weeks of drought in the month of May; and before the end of the year the surface showed in many places a verdure consisting of a broad-bladed grass different from the original, but a poor substitute for the corn which should have filled its place.

In the end of the year 1852, the ground was ploughed a second time with rather less trouble and risk, and the same kind and quality of seed and manure were sown in it next spring. The braird came up more equally than last, but the drought again took effect upon it, and it went greatly off, and what did remain came to a poor account, so that only a few quarters of grain were secured. Two bushels of grass seed per acre were sown along with the oats, which grew pretty well, and afforded some pasture to sheep during autumn. This had likewise the effect of keeping down weeds; and the trampling of the sheeps' feet had a good effect in levelling down and comminuting the furrows, which with the pasture afforded more than repaid the cost of the seed. In the autumn, sand, at the rate of 200 loads per acre, was driven and spread over the surface of the ground, which was afterwards ploughed a third time for the present year's crop, the doing of which was comparatively an easy process; and it assumed for the first time something like a subject for growing a crop. Wet spots throughout were dried by tile drains, and the winter's frost pulverised the furrows, so that a tolerably good mould was got for the seed in spring. White oats were sown in the beginning of April, and, with the exception of one or two acres of partial failure, a crop of nearly 4 quarters per acre, on an average, was reaped. The corn was rather unequal in length of straw and thickness in the ground, but it reaped pretty equally. The sanding had no doubt an excellent effect; in fact, this was seen in certain places where it was thickly laid on. The sand being beside the moss cost only about 10s. per acre for men and horses' work. This cannot be reckoned fairly against one or two years' crops, as the benefit must be so far permanent.

The outlay and returns now stand thus:—

	Per acre.		
To draining,	£4	10	0
„ paring,	1	0	0
„ ploughing and harrowing 3 times,	4	0	0
„ seed for 3 years,	2	14	0
„ harvest work,	1	0	0
„ 6 cwt. of guano,	3	0	0
„ sanding,	0	10	0
	£16	14	0
By 5 qrs. 6 bushels of oats, with fodder, at £1, 8s. per qr.,	£8	1	0
Present outlay, per acre,	£8	13	0

A portion of the field—for it may now be dignified by such a title—was set apart for the experiment now about to be detailed, which was ploughed and sown with sandy oats along with the rest of the field.

As it is beyond his province in this paper to speak of the other description of mosses, the Reporter shall take leave only to say, that he was desirous of including in his experiments the *meadow moss* above referred to, as he believes the reclaiming of it would, in all cases where practicable, and where considerable tracts of it lie contiguously, be both easy and profitable to accomplish. It is really pitiful to see at this day so much of this quality of ground no better employed—and, from its wetness and other causes, cannot be so—than to produce a wretched herbage some 6 or 8 inches long, termed hay—the cutting and securing of which are often more than its intrinsic worth; while it could be made into good corn and turnip land.

The amount of both corn and straw, and their value, are given in detail, and how manured, so that the effects of each kind of manure can be ascertained at a glance. One exception, however, at least, must be made in this respect at No. 3 in the experiments on the flow moss, where it is shown that the value of the produce of 3½ cwt. of guano was less than three of the others. Now, it must be explained that the guano produced too much crop, more than the moss was able to carry; and it was laid before being ripened, and the second growth shot through. This was the only ridge where the crop was laid, showing that less quantity would have been sufficient and more profitable; and, as a further proof, it will be seen that, at No. 9, where the next greatest quantity of guano was used, and where indeed it was the standard manure, the yield per acre was greater by more than a pound's worth than any other of the manures, either singly or collectively, produced. So there is no doubt of the superiority of guano over any of the other manures on this kind of moss, as far

as these experiments are a guide. The sulphate of soda, and nitrate of soda, seem to have been failures; and the lime had very little effect either, but it may act afterwards. The sulphate of bones is undoubtedly next in quality, although considerably behind the guano.

In regard to the experiments on the meadow moss, it has to be remarked, that the first four numbered ridges ripened sooner than the others by five or six days. Here the sulphate of bones did fully better than the guano, and was much preferable to the crushed bones. The salt and the charcoal had a tolerably good result, although the latter by itself, as also the sulphate of ammonia, did little good. In conclusion, it may safely be said that peat, more especially flow moss, can be best brought, after being drained, into profitable cultivation, as far as manure is concerned, with guano; or, if it cannot be got, sulphate of bones, adding, if possible, plenty of sand to supply it with silica, which is the radical want of all such soils.

EXPERIMENTS

EXPERIMENTS ON FLOW MOSS.

Ridge.	Quantity of Ground.	Manure, at rate per Acre.			Cost per Acre.		Returns in Grain.		Quantity per Acre.		Weight per Bushel.	Returns in Straw.	Quantity of Straw per Acre.	Value of Grain and Straw per Acre.		
			s.	d.	s.	d.	bush.	lb.	bush.	lb.	lb.	lb.	stones.	£	s.	d.
1	10 poles	1 cwt. guano cost	10	0	38	0	2	25	42	10	38½	148	169	8	9	0
		2 cwt. sulphate of bones,	15	0												
		1½ barrels of lime,	13	0												
2	...	1 cwt. guano,	10	0	25	0	3	6	50	18	39	150	171	9	14	6
		2 cwt. sulphate of bones,	15	0												
		200 loads of sand,														
3	...	3½ cwt. of guano,	35	0	35	0	2	20	40	8	39	186	212	8	13	7
4	...	4½ cwt. sulphate of bones,	33	9	33	9	2	30	44	12	39	163	186	8	14	0
5	...	320 loads of sand,			...		2	1	32	16	39½	125	143	6	14	0
6	...	Nothing,			...		1	36	31	0	38½	110	126	6	3	6
7	...	34 barrels of lime,	36	10	36	10	2	8	35	11	39	128	146	7	2	6
8	...	2 cwt. sulphate of soda,	10	0	36	3	1	37	31	7	39	120	136	6	7	6
		1¼ cwt. nitrate of soda,	26	3												
9	...	2½ cwt. of guano,	25	0	35	0	3	24	53	0	38½	200	230	10	15	0
		2 cwt. sulphate of soda,	10	0												
10	...	1¾ cwt. nitrate of soda,	36	9	36	9	2	32	40	23	38½	145	166	8	2	0

EXPERIMENTS ON MEADOW MOSS.

Ridge.	Quantity of Ground.	Manure, at rate per Acre.	Cost per Acre.	Returns in Grain.	Quantity per Acre.	Weight per Bushel.	Returns in Straw.	Quantity of Straw per Acre.	Value of Grain and Straw per Acre.
			s. d.	bush. lb.	bush. lb.	lb.	lb.	stones.	£ s. d.
1	10 poles	3 cwt. sulphate of bones, . .	22 6	3 18	55 7	38	210	240	11 5 6
2	...	8 bushel of ground bones, . .	22 8	2 37	47 7	39	170	194	9 10 0
3	...	2 cwt. of guano, ... 25 loads of sand, ...	20 0	3 12½	53 10	38	209	238	10 19 3
4	...	2 cwt. guano, ...	20 0	3 5	50 4	38	190	217	10 4 6
5	...	2½ barrels of lime, ...	21 8	2 20½	40 24	38	150	171	8 5 0
6	...	4 cwt. charcoal, 10s., . . 4 cwt. of salt, 6s., . . .	16 0	3 1	48 16	38	186	212	9 18 3
7	...	Nothing, ...	...	2 18	39 25	37½	145	166	7 11 6
8	...	Sulphate of ammonia, . .	22 0	2 31	40 36	37½	160	206	8 7 6
9	...	8 cwt. of charcoal, ...	20 0	2 22	40 0	38	154	183	8 5 6

REPORT ON PLOUGHING LEA.

By Mr WILLIAM M'LEOD, Fetternear, Aberdeenshire.

[Premium—The Medium Gold Medal.]

DURING the past crop and year 1854, an experiment on the different modes of ploughing lea was made by the reporter on the home farm of Fetternear, the property of Colonel Charles Leslie, K.H., of Balquhain. Fetternear has long been the seat of the Balquhain family in Scotland, and lies in the parish of Chapel of Garioch, about sixteen miles north-west of Aberdeen, and on the north bank of the river Don.

The reporter had listened to the arguments of theorists, and to the opinions of practical farmers, and having heard the whole of the following modes of ploughing commended in their turn, each having its advocates, was desirous to make a trial by accurate experiment, which he hopes will aid to determine the important question of what is the proper depth and shape of furrow, and what is the proper tool for forming it. The experiment was made upon old infield land, having a fine friable black loamy soil of equal texture, varying from 18 to 20 inches in depth, lying on a subsoil of yellow sandy clay, having a westerly exposure of 14 feet horizontal to 1 perpendicular, and worth about 35s. per acre of yearly rent. The experiment was repeated upon an adjoining field of outfield land, having a poor blackish soil, from 7 to 10 inches deep, lying on a subsoil of hard stony clay, intermixed with iron, the exposure southerly, with a slope much the same as the last-mentioned field, and worth about 14s. per acre of yearly rent.

Both fields are without much shelter, and lie at an average altitude of 475 feet above the level of the sea, which may be reckoned a favourable height for the growth of grain crops.

The rotation of both fields was that of alternate husbandry prior to 1845, when, after receiving a proper quantity of dung and bones for a turnip crop, and a sufficient liming the following spring, they were sown down with grass seeds, along with a crop of oats, and have since been pastured by black cattle. During that time the fields have profited but little, being wet, especially the outfield land, which lies on a retentive subsoil. This may account for the smallness of the crops compared to what might have been expected after a rest of some eight or nine years. The land was

thoroughly drained in the autumn of 1853, previous to ploughing, which will no doubt, after proper tillage and manuring, enhance the value of the future crops.

About the middle of January, three plots were measured off on each field, containing 1 acre each, which were ploughed respectively in the following manner:—

Plots I. By the trench plough.
 „ II. At the ordinary depth, with a high crest or shoulder.
 „ III. At the ordinary depth, with a rectangular shoulder.

The ploughs were all held by an experienced ploughman, and the work was of a superior kind.

The corn sown on both outfield and infield land was Scotch barley, good quality, and was selected for the purpose.

The following tabular statements show the particulars, expense, and produce of each plot separately.

No. I. Tabular Statement

No. I.—Tabular Statement of Expense on Outfield Land.

		Ploughing								Sowing				Reaping			
No. of Plot.	Quantity of land in each Plot.	Date of ploughing.	Kind of furrow.	Breadth of furrow.	Depth of furrow.	Time required for ploughing.	No. of horses in plough.	Cost of horses per hour.	Cost of ploughing.	Date of sowing.	Quantity of seed sown.	Cost of seed.	Cost of harrowing and rolling.	Date of reaping.	Cost of reaping and carrying.	Cost of threshing.	Total Cost.
	ac. ro. po.	1854.		in.	in.	ho. mi.		s. d.	£ s. d.	1854.	b. pk.	£ s. d.	£ s. d.	1854.	£ s. d.	£ s. d.	£ s. d.
I.	1 0 0	Feb. 8.	Trench, ...	14	10	8 0	3	1 6	0 12 0	Mar. 21,	6 3	1 7 0	0 4 0	Sept. 7,	0 10 0	0 2 9	2 15 9
II.	1 0 0	Feb. 9.	High Crested,	9	5½	12 0	2	1 0	0 12 0	Mar. 21,	6 3	1 7 0	0 4 6	Sept. 1,	0 10 0	0 3 2	2 16 8
III.	1 0 0	Feb. 11.	Rectangular,	9	5½	12 0	2	1 0	0 12 0	Mar. 21,	6 3	1 7 0	0 4 6	Sept. 1,	0 10 0	0 3 4	2 16 6

No. II.—Tabular Statement of Expense on Infield Land.

		Ploughing								Sowing				Reaping			
No. of Plot.	Quantity of land, in each Plot.	Date of ploughing.	Kind of furrow.	Breadth of furrow.	Depth of furrow.	Time required for ploughing.	No. of horses in plough.	Cost of horses per hour.	Cost of ploughing.	Date of sowing.	Quantity of seed sown.	Cost of seed.	Cost of harrowing and rolling.	Date of reaping.	Cost of reaping and carrying.	Cost of threshing.	Total Cost.
	ac. ro. po.	1854.		in.	in.	ho. mi.		s. d.	£ s. d.	1854.	b. pk.	£ s. d.	£ s. d.	1854.	£ s. d.	£ s. d.	£ s. d.
I.	1 0 0	Jan. 23,	Trench, ...	16	11	8 0	3	1 6	0 12 0	Mar. 16,	6 2	1 6 0	0 3 6	Sept. 7,	0 12 0	0 4 0	2 17 6
II.	1 0 0	Jan. 25,	High Crested,	9	5½	12 0	2	1 0	0 12 0	Mar. 16,	6 2	1 6 0	0 4 0	Sept. 4,	0 12 0	0 4 3	2 18 3
III.	1 0 0	Jan. 26,	Rectangular,	9	5½	12 0	2	1 0	0 12 0	Mar. 16,	6 2	1 6 0	0 4 0	Sept. 4,	0 12 0	0 4 1	2 18 1

Monthly Remarks on the Weather, and Comparative Progress of the Plots.

May 1, 1854.—The weather has been extremely dry during the whole of the bygone month. Land was perhaps never seen in a drier state, no rain of any consequence having fallen for the greater part of the last three months, until the end of the past month, when cold showers of hail fell accompanied with thunder. The depth of moisture of the past month might be stated at three-tenths of an inch, and the temperature ranged from 25 to 65 degrees.

OUTFIELD.

May 1.—All the plots came into braird much about the same time. Little difference can be marked. The whole of the plots seem sickly—a thing not uncommon between the first and second stages of growth. All seem thick—the only visible difference is, that the braird on No. I. is much evener over the ground than either No. II. or III.; both the latter have a tendency to grow by the seam.

INFIELD.

May 1.—Plot No. I. came last into braird, but is now much yellower in colour, and the plants are thicker, and have not that tendency to grow by the seam which Nos. II. and III. have; they came into braird a few days before No. I., and are now much greener and healthier looking. There can be no distinction made between Nos. II. and III.; both seem to be entered on the second stage of growth, while by appearance No. I. has not completed its first—at all events, has not as yet made any visible progress in its second.

June 1, 1854.—The weather during the past month has been most favourable to vegetation, more so than it has been during the corresponding period of a number of years; rain has fallen in abundance, the depth of which may be stated at 3½ inches, and the temperature varied from 30 to 70 degrees.

OUTFIELD.

June 1.—Plot I. is much yellower in colour, and not so far advanced in growth, as either plots II. or III., which are much healthier looking, and seem both about equal in their growth: if any difference can be marked, No. II. has the superiority.

INFIELD.

June 1.—Plot I. seems very unequal in its growth, small tufts appearing very luxuriant, while the intervening spaces appear stunted and sickly, and have from some cause lost a number of plants between the first and second stages of growth, which have, however, to a certain extent, been replaced by new shoots, although it is yet scarcely equal to the others in point of thickness. Nos. II. and III. are more equal and healthier; on the latter two, no distinction can be made; both seem ahead of No. I.

July 1, 1854.—The past month has carried little of the characteristics of the season; it commenced with cold dry winds alternately from the north and east, and continued so up to about the middle of the month, when it became more mild, with plenty of rain, which continued nearly to the end of the month, when it became dull and foggy. On the whole, the past month may be

said to have been unfavourable to the growth of all kinds of crops: the depth of rain may be stated at 3¼ inches, and the temperature ranged from 43 to 65 degrees.

OUTFIELD.

July 1.—Plot I. is still a little behind the other two; it has, however, advanced greatly since the commencement of the past month, though it is scarcely equal to the others, on which some of the ears are beginning to appear.

INFIELD.

July 1.—Plot I. has advanced greatly in growth since the commencement of last month, being now alike with the others, and very equal in growth; no tufts appearing as mentioned in last month's remarks. All seem about one stage of growth, some of the ears beginning to appear over all the plots.

August 1, 1854.—The past month has been all that the agriculturist could have wished for; the rain fell plentifully in the beginning, followed by keen breezes of wind and dry weather towards the end of the month. Crops of all kinds have increased very rapidly in growth. The thermometer stood at an average of 66 degrees, but on one occasion was as low as freezing-point, and the frost was observed white in the shade, but luckily did no harm.

OUTFIELD.

August 1.—Plot I. is unequal, and behind the others, and must now remain so, being at its full growth; Nos. II. and III. have advanced a stage farther towards ripening than No. I., and seem both to excel it in point of bulk.

INFIELD.

August 1.—All the plots seem at their full growth, and may be reckoned an average crop; any distinction that can be made is, that Nos. II. and III. seem advanced a stage towards ripening, while No. I. has only arrived at its full growth.

September 1, 1854.—The past month has been very propitious for the crops, rain having fallen at seasonable intervals up to the middle of the month, when bright sunshine accompanied with keen breezes set in, which has ripened and brought the crops to maturity with astonishing rapidity. The thermometer ranged from 56 to 79 degrees.

OUTFIELD.

September 1.—The crops of Nos. II. and III. are now ready for the sickle, while No. I. is still behind, and presents an appearance of unequal ripening, although the weather has been most favourable.

INFIELD.

September 1.—Plots II. and III. are nearly ready for the sickle, and are very equally ripened, while No. I. is less so, but will not be long after the others, as the difference is but trifling. All seem an average crop, but Plot I. is thinner and coarser straw than either of the other plots.

No. III.—Tabular Statement, Value of Crop on Outfield Land.

No. of Plot.	Kind of furrow.	Quantity of seed sown.	First-Class Oats. Quantity.	Weight per bushel.	Price per quarter.	Value.	Second-Class Oats. Quantity.	Weight per bushel.	Price per quarter.	Value.	Shillocks. Weight per acre.	Value.	Straw. Quantity.	Price per ton.	Value.	Total value of Outfield crop.
		qr. b. pk.	qr. b. pk.	lb.	s. d.	£ s. d.	b. pk.	lb.	s. d.	£ s. d.	lb.	£ s. d.	t. cwt. qr. lb.	s.	£ s. d.	£ s. d.
I.	Trench,.......	0 6 3	3 6 2	41½	24 6	4 13 5	2 2	39⅓	22 6	0 7 0¼	28	0 1 2	1 0 2 6	20	1 0 6½	6 2 1¾
II.	High-crested,	0 6 3	4 2 0	41¾	24 9	5 5 2¼	4 0	40	23 0	0 11 6	60	0 2 6	1 6 1 12	20	1 6 4¼	7 5 6½
III.	Rectangular,	0 6 3	4 4 0	41	24 0	5 8 0	4 0	39	22 0	0 11 0	40	0 1 8	1 3 3 14	20	1 3 10½	7 4 6½

No. IV.—Tabular Statement, Value of Crop on Infield Land.

No. of Plot.	Kind of furrow.	Quantity of seed sown.	First-Class Oats. Quantity.	Weight per bushel.	Price per Quarter.	Value.	Second-Class Oats. Quantity.	Weight per bushel.	Price per quarter.	Value.	Shillocks. Weight per acre.	Value.	Straw. Quantity.	Price per ton.	Value.	Total value of Infield crop.
		qr. b. pk.	qr. b. pk.	lb.	s. d.	£ s. d.	b. pk.	lb.	s. d.	£ s. d.	lb.	£ s. d.	t. cwt. qr. lb.	s.	£ s. d.	£ s. d.
I.	Trench,.......	0 6 2	5 2 0	43½	26 6	6 19 1½	5 3	42	25 0	0 17 11½	62	0 2 7	1 10 0 0	20	1 10 0	9 9 8
II.	High-crested,	0 6 2	5 6 0	42¼	25 3	7 5 2¼	5 0	41	24 0	0 15 0	56	0 2 4	1 11 0 11	20	1 11 1	9 13 7¼
III.	Rectangular,.	0 6 2	5 5 1	43½	26 6	7 9 10½	4 0	42¼	25 3	0 12 7½	60	0 2 6	1 10 2 6	20	1 10 6½	9 15 6½

The exact profits on each plot, both on outfield and infield land, will be seen from the following tabular statements:—

No. V.—TABULAR STATEMENT, PROFIT ON OUTFIELD LAND.

	Trench.	High-crested.	Rectangular.
Expense, . .	£2 15 9	£2 16 8	£2 16 6
Produce, . .	6 2 1¾	7 5 6½	7 4 6½
Profit, . . .	£3 6 4¾	£4 8 10½	£4 8 0½

No. VI.—TABULAR STATEMENT, PROFIT ON INFIELD LAND.

	Trench.	High-crested.	Rectangular.
Expense, . .	£2 17 6	£2 18 3	£2 18 1
Produce, . .	9 9 8	9 13 7¼	9 15 6½
Profit, . . .	£6 12 2	£6 15 4¼	£6 17 5½

The weather (with the exception of a little drought in the beginning of spring, which prevented the crops from coming so equally into braird as they otherwise would have done) has been excellent. Indeed, it has scarcely been equalled within the memory of the oldest inhabitant; so that there was no drawback on that point; and it is the reporter's opinion that the comparison was as fairly made as might well be. He would now beg to offer a few remarks on the different ploughs, commencing with the trench-plough, which he thinks, for the ploughing of lea, especially on poor land, may be fairly laid aside, for the following reasons, viz.: Deficiency in money-value; excess of draught, being above the power of three ordinary horses to draw with freedom of pace; the lateness and unequal ripening of its crops, caused by too much of the insipid soil being turned up, which is also the cause of a number of the weaker plants dying between the first and second stages of growth; and, on the whole, there seems little to justify its use upon any kind of soil. With regard to the rectangular and high-crested cutting ploughs, the difference on both outfield and infield land is so little that it is difficult to say which is the most profitable, although there appears a small balance in favour of the rectangular plough. The reporter has no objection to the high-crested furrow in lea ploughing, but taking into account the utility of the rectangular-cutting plough, he is inclined to think that it should take the place of all others in general tillage.

Although a little foreign to the subject, the reporter would here take the liberty of making a remark on deep ploughing, as the result of his experience. Let it be done in the autumn, before a green crop is put into the ground; but previous to this let the

subsoil be stirred to a sufficient depth, say 12 or 14 inches, as it gives the trench-plough facilities for turning up particles of the subsoil, which, when mixed with the upper soil, give a new stimulus to the land, and also allow the roots of crops to penetrate more easily into the ground in quest of food. With such substitutes for the old Deanston subsoil-plough (as Sellar and Son's, Lord James Hay's, and others), it is within the reach of the small farmer to have at least his retentive bottoms stirred, especially where draining has been effected.

If such operations were carried out, the reporter has no doubt it would amply repay the outlay; and he gives it as his opinion, that from 5 to 6 inches is the most profitable depth for the ploughing of lea,which can be done with equal profit by the high-crested or rectangular-cutting plough.

REPORT OF PLANTING ON THE ESTATE OF BALGOWAN, Aberdeenshire.

By ROBERT SMITH, Esq. of Glenmillan, Advocate, Aberdeen.

[Premium—The Gold Medal.]

IT is not presumed that, in the following Report, anything new or extraordinary will be found by those who have directed their attention to the subject of planting. It is hoped, however, that to proprietors and others who have not yet taken a personal interest in the subject, or who have hitherto been deterred from planting on account of its fancied large expense, the following example, on a moderate scale, and of the cheapest kind, may be useful; and that to others of larger experience it may prove in some degree interesting, when brought into comparison with works of a similar kind executed by themselves. It is doubtless for such objects as these that the Highland Society invites reports on the forming of young plantations.

The estate of Balgowan, belonging to the trustees of the late Robert Charles Grant, Esq., lies on the north side of the Don, about 25 miles from Aberdeen, the nearest seaport. It is in the immediate neighbourhood of rich agricultural districts, being on the north-east side of the Vale of Alford, and separated from the valuable district called "the Garioch" only by part of the Benachie range of hills. It is also within six miles' distance of the Great North of Scotland Railway, so that, from general as well as local markets, the prospect of sales of wood is amply encouraging. The Hill of Cardensbrae, the subject of this Report, forms the northern portion of the property, and contains, within the enclosures now made, about 190 acres.

The planting took place in the spring of 1851, circumstances having occurred to prevent its completion in the preceding autumn, as originally desired.

The reporter will follow the order of particulars suggested by the Society; and, first, as to expense.

EXPENSE.

The expense of formation divides itself into two heads—Enclosing and Planting. The ground, being naturally dry, required no draining, except at one point, where complete drainage is effected by a large march-ditch, and a few small drains running into it. The expense of these is included in the general fencing account. The plantation extends for some distance to the extreme boundary of the property, and as there were formerly no march-fences with the lands of the neighbouring proprietors, they paid one-half of the cost, so far as their grounds extend. Along almost the whole of the remaining fences there is arable land belonging to Balgowan. This land was formerly unfenced, but one-half of the expense is charged against the planting. In this way the total expense of fencing is as follows:—

Dykes and ditches, forming marches with neighbouring proprietors, Lord Forbes and Sir A. Leith Hay, £104, 14s. 4d., one-half of which, payable by Balgowan, is	£52	7	2
Dykes between plantation and arable lands on Balgowan, formerly unfenced, including carriage of part of the materials, £118, 15s., one-half of which, charged against plantation, is	59	7	6
Cutting out whins where strong, ...	10	0	0
	£121	14	8

The extent being 190 acres, the average expense of enclosing per acre is thus about 12s. 9d.

The fences are sunk dykes with stone facings. The sunk is cut at an angle of 3 to 1, 6 feet wide at top and 4 feet at bottom, on an average 2½ feet deep, with strong feal not less than 12 inches long, properly banded, the one run out, the other in; the earth backing on an angle of not less than 2 to 1, firmly beat and neatly dressed, and the finished top not less than 18 inches wide. The stone facing is built to a frame of 20 inches wide at bottom and 12 inches at top, 4 feet high, with a coping consisting of two rows of turf, having the earthy sides put together, and above the turf a course of stones set on edge, the whole standing 4½ feet high.

The average expense of dykes was about 9d. per yard, including carriages, the materials being close at hand. The tenant of one farm performed part of the carriages without payment, the dyke being a fence for his arable land. The expense of planting was 12s. per acre, and the expense of enclosing, as before, being 12s. 9d., the total cost of the plantation was £1, 4s. 9d. per acre.

The value of the ground, before planting, was scarcely appreciable; and no allowance was made to the tenants in respect of their right of pasturage being withdrawn.

NATURE OF SOIL.

The hill rises in an elongated form from south to north, no part of the north side belonging to Balgowan. The shoulders to east and west extend for the most part to arable lands. On the brow of the hill, fronting south, there is a thin vegetable surface, generally from 2 to 3 inches deep, in some places slightly mixed with moss, then dry gravelly soil incumbent on granite. On the east and west shoulders, after a thin vegetable surface, there is in many places red clay of various depths, from an inch or two to 2 feet, and in other places a mixture of gravel and clay, tending rather to clay, and all finally incumbent on granite. The chief vegetation on the hill, before the planting, consisted of heather, with some mosses and cranberry-bushes, and a little rough grass on the lower grounds. There is not much of that hard incrustation called pan, which proves so deadly an enemy to many plantations. But in some places it exists to a certain extent, and if *there* it should prove too hard or deep for the roots to pierce, the prospect of good wood, particularly of larches, is but slight. On the subject of pan, some remarks will be made under the head of "General Observations." The exposure is chiefly south, sloping from the highest point to arable lands on the east and west. It will not be greatly affected by north winds, but it cannot be said to have shelter from any other quarter. The altitude probably ranges from 700 to 800 feet above the level of the sea.

AGE, KIND, AND NUMBER OF TREES.

The ground was planted by contract by Messrs John Gregor & Co. of Forres. The contract provided that the contractors should put in 2400 two-years seedling Scots firs, and 600 two-years seedling larches per acre; and they rather exceeded the prescribed number of larches. They were also bound, under the contract, to beat up and uphold the planting for four years, leaving at that time the full number of 3000 plants per acre in the ground. Three-fourths of the price was, in terms of the contract, paid at completion of the planting, and the remaining fourth part will be paid at the end of the four years, when the work is taken off the contractor's hands. No hard-wood trees were planted on this hill, partly because of their exposure to the destruction of game, and because it was desirable to form the plantation at a low expense, but chiefly because another part of the property was thought to be more congenial and suitable for hard wood. On Cardensbrae, no doubt, hard wood would have grown, particularly along the back of the sunk fences, but probably only to become

stinted and destroyed by the ravages of hares and other game. The remoteness of the situation would have made it a peculiar prey. The proportion of Scots firs to larches may appear great, but the Scots fir was felt to be the safer crop, and yet the number of larches, if they shall prosper, is sufficient to give a fair proportion of them, by confining the thinnings very much to Scots firs.

MODE OF PLANTING.

The planting was executed by men, who made use of the common hand-iron, about 2 feet long. Although a little expense may be saved by the employment of women and boys as planters, the reporter, from all the experience he has had, gives the preference to men, particularly where the soil is tough or covered with a thick foggage. He has no improvement to suggest on the common hand-iron. The great object to be observed is, that the roots of the plant be introduced thoroughly into the soil, however thick and close the heath or herbage may be; and that the earth slit be at once firmly compressed by the foot of the planter.

DRAINING.

As already stated, the ground, being naturally dry, and no part of it level, required very little draining. The only wet part happened to be near one of the boundaries, and the expense of draining is embraced in the general fencing account, as formerly stated.

PROGRESS OF THE PLANTS.

In the first season the growth was of course very inconsiderable, but the plants had rooted well. In the second the larches grew several inches, averaging from 4 to 6, the Scots firs rather less, and in the third the larches from 8 inches to a foot, the Scots firs about 4 inches. During the fourth or present year, many of the larches have grown 20 inches, the average being about 14; the Scots firs 6 to 10 inches, the average being about 7.* The whole appear to be healthy and vigorous, and there are very few blanks. The hill already presents an appearance of waving green, when viewed from no great distance. The growths at the ages stated may be considered as fair averages on hill ground. In subsequent years a quicker advancement may be expected; the Scots firs averaging probably a foot, and the larches a foot and a half. The larch seems to be naturally a quicker-growing tree than the Scots fir, but this may in part be explained from the different periods of their growth. The Scots fir grows only in the months of May, June, and July, and if in these months there be an average fall of rain, the plants will have vigorous growths. The larch,

* The progress for season 1855 has been equally satisfactory. December, 1855.

again, takes its growth later in the season, and, unless checked by frosts, grows much longer, at a time too when, in this country, there is usually a larger fall of rain.

GENERAL OBSERVATIONS.

Under this head, the reporter ventures to offer some practical remarks which appear to him worthy of observation in the forming of fir plantations.

If a proprietor intends to plant any part of his waste lands, he should prohibit all casting of feal or turf from such lands, and the burning of heath. When the feal or turf is removed, there is not only a withdrawal of part of that scanty soil in which the plants are first to grow, but from this, or even from the burning of heather, there is an exposure, and consequent coldness and dryness created, very unfavourable to the growth of plants. If the heather is so rank as to prevent the operation of planting, it may be burned; but in that case the planting should be deferred for two or three years, that a fresh crop of heather may be rising.

Where whins exist to a great extent, they should be cut out, but where they are not very thick and strong, this expense may be avoided; and if well-grown plants are used, they will overcome the whins. Not so as to broom. It should be completely extirpated before the planting commences,—torn up by the roots by means of a broom-dog or other instrument. Broom is a deadly enemy to young trees, frequently breaking the leaders by lashing them in the wind. Whins, when rank, may and do choke tender plants, but they do not lash them, lying much closer and lower in their branches than broom.

As regards the season of planting, the autumn is clearly the best where the ground has not been trenched or pitted. The wet of winter tends to fill up and thoroughly close the slit formed in planting, before the sunshine and drought of spring and early summer arise, which are very apt to reopen the slits of spring-formed planting.

It is almost unnecessary to refer to the necessity of fencing and draining. After a fence is completed, very little expense is incurred, if a trusty labourer is at once put in charge to walk round it now and then, and repair any little damage from time to time as it arises. As to draining, the same course may be taken. The requisite drains are presumed to be put in before planting, and he has only to see that they are in working order, and that no stagnant water exists.

As to the choice of plants, observing that this paper is confined to the fir tribe, the reporter will make one or two remarks. If the soil is inclined to damp, it is in vain to plant Scots firs; they will not grow to good sizes in wet land. The larch will grow to maturity in a more moist soil than the Scots fir, and spruces than

in either. Both larches and Scots firs prefer an open bottom, but for the former it is even more necessary than for the latter. Where *pan** exists, Scots firs have the better chance of success, but neither they nor larches will come to maturity if it be to a great extent. This pan, so frequently existing in some parts of Scotland, is most capricious, both in the depth of soil at which it occurs, in its own depth and hardness, and in the particular portions of any given piece of ground where it establishes itself. Generally, if it prevails at all, it does so more or less in the whole adjoining grounds, but frequently it seems to disappear or become so slight, as to produce no effect even in the immediate neighbourhood of its strongest virulence. Pan has done much to mar the efforts and disappoint the expectations of planters. As it is quite out of the question to incur the expense of stirring or digging below this pan, on any extensive scale, the only remedy that has occurred to the reporter, besides proper drainage, is to thin the trees freely, and thereby give to the roots the benefit of as much of the surface-soil *above the pan* as possible, so that they may become as strong as the over-pan soil will permit, or become vigorous enough to pierce it. Unless the pan is near the surface, and the ground on a level, Scots firs are not so much affected by it, as they spread their roots to little depth; but a good crop of larches cannot be expected where the pan is unpierced. The roots of hard wood seem to be stronger, and to get through a pan better than firs. As to *elevation*, the reporter is of opinion that larches and Scots firs will both thrive to about an equal elevation, but if there be a difference, it is in favour of larches. He can point to some experiments on this subject at Glenmillan, where, on an elevation of about 1000 feet, larches of twelve years old are growing at an average rate of 16 inches per annum. The Scots firs are not progressing nearly so fast, and in many places are very unhealthy, probably from frequent wetness, emerging from the summit of the hill adjoining, which is rather flat. Great elevation does not appear at all times a sufficient barrier to successful planting. Let the planting be proceeded with gradually within a certain radius,—that radius extending from time to time at each fresh operation. The first circle of plants will form a shelter to the second, the second to the third, and so on, until the hill on both sides is breasted; and, if the elevation be not very great, the plants meet on the top, thus covering the entire hill. If the summit is at such an elevation as to forbid success, the breasting may be made without reference to an uniform rule, running into arms and corries which occur, where advantage may be taken of the natural shelter of higher elevations, to be themselves left unplanted.

As respects thinning, the reporter recommends that it be begun

* Generally a ferruginous incrustation in the soil.

so soon as the trees interweave each other. This is requisite to give air and light to the plants, and to afford more soil to their roots. It is also to be observed, that if thinning is not then begun, the first severe snow-storm will probably break down half the trees and more than half the leaders, as the snow gathers on the tops and branches, having no room to fall to the ground. Larches require to be more freely thinned than Scots firs; the points of their longest branches should never more than touch each other. Air, light, and absence of damp seem the best preservative for this valuable but of late years rather delicate tree. The extent of thinning for Scots firs must be regulated entirely by the nature of the soil, some soils affording a much larger crop than others. As a general rule, firs on an open bottom may be left much thicker than those on a close one; but in all cases let the thinning go on gradually and steadily.

As to the returns for fir plantations, if not so large, they are much quicker than those for hard wood. Many grounds—for example, the subject of the preceding report—are not suited for hard wood; but, even if they were, it is doubtful if they would realise in the same time so much money. For the first twenty-five years, it may be prudent to assume, that, in a purely agricultural district, where there is not a scarcity of wood, no return whatever will be derived from a larch and Scots fir plantation, any price obtained for thinnings being exhausted, if not more than exhausted, in the expense of cutting. In ordinary cases, after the lapse of twenty-five years, or say thirty years at the most, the thinnings become fit for fencing, coal-props, &c.; and if the plantation be a thriving one, and the locality within an average distance of conveyance by water or rail, say five miles, the returns become considerable. It were a very moderate estimate to say, that, for the period of the plantation's age, between thirty and forty, a free annual return of 10s. per acre may be obtained. At the end of forty years, we may assume that four hundred and fifty trees per acre will remain, say one-half larch and one-half Scots firs. If still in a thriving condition, few will be sold for some years; they are too old for coal-props and fencing, and generally too young for flooring, railway sleepers, &c. They are now in a state when their annual increase in growth and value is very great. At the end of sixty years, the intervening period from forty has probably disposed of one hundred and fifty trees per acre, at an average price, we shall assume, of only one shilling per tree after deducting expenses and allowing for dead trees, giving £7, 10s. per acre. We have now three hundred trees remaining for each acre, and shall suppose that they consist of larches and Scots firs equally. Of course there will be considerable variety in the size, but, assuming that each acre contains

Fifty larches, worth on an average only 5s. each, . .	£12 10 0
And fifty Scots firs, worth 2s. 6d., ...	6 5 0
With the remaining two hundred trees, consisting of larches and Scots firs, at say an average of only 1s. 6d. . .	15 0 0
We have a total value per acre of	£33 15 0

The result of the foregoing estimate would stand thus:—

Original expense of planting and enclosing, £1, 4s. 9d. per acre, or say	£1 5 0
Compound interest at five per cent for thirty years, the thinnings to that date being held as an equivalent for the expense of cutting, &c., ...	5 8 0
Total per acre, . . .	£6 13 0

For the period of the wood's age, between thirty and forty, we held the thinnings as worth 10s. per annum per acre; but as the reporter would rather have his estimate below than above the truth, we shall place the return for this period simply as equal to the current interest then accruing. For the period of growth, from forty to sixty, we have estimated the return at only £7, 10s. per acre, that being a time when it is desirable to cut as few trees from a thriving wood as possible—

Or per acre, per annum, ...	£0 7 6
Less interest on £6, 13s. amount of expense, and compound interest thereon, as before, ...	0 6 8
Leaving per acre, per annum, .	£0 0 10
And giving for twenty years, per acre, ...	£0 16 8
The price at the end of sixty years was estimated as before, per acre, at	33 15 0
Making total of	£34 11 8
From which deduct original outlay and compound interest,	6 13 0
Free balance per acre, . . .	£27 18 8

Or taking the full amount for a plantation of the extent of that reported on (190 acres), we have—

Original cost and compound interest as before, one hundred and ninety at £6, 13s., ...	£1263 10 0
Price do. at £34, 11s., 8d., ...	6570 16 8
Balance or gain, . .	£5307 6 8

This return is equal to a rent at the rate of 9s. 3d. per acre per annum for sixty years, for ground literally worth nothing before, besides leaving a surface of decayed vegetable matter, growing pasture-grass in place of heath, and having all along afforded shelter and beauty to the adjoining grounds.

By some the preceding estimate will be thought too high, by many too low. The reporter admits that the value to which a

young plantation will arrive cannot be predicated with certainty. There is an infinite variety of causes that may supervene to affect it —soil, seasons, state of markets, &c. He can point to a plantation, chiefly of larches, on the estate of Finzean, Deeside, about fifty years of age, already worth about £80 per acre; and, in other parts of the country, to plantations of almost equal age, not worth much more than £5 per acre. But in any view, if the expense of planting is not above an average, and if the soil is not wholly unsuited for it, it is a good investment. The returns by way of shelter, amelioration of climate, increase of pasture-grass, and ready wood for smaller country purposes, if not for extensive sales, afford an ample remuneration for the original cost.

It is thus clearly established that, even in the bare aspect of a mercantile transaction, the cultivation of wood forms a safe and remunerative investment; but there is much beyond this to render it full of attraction to every lover of nature, and every man of taste. There are few who do not associate their earliest recollections of country scenery with trees—probably with well-known individual trees. They remember the sweet music of their murmurings, their cooling and refreshing foliage, and the exquisite beauty of their lights and shades. All are agreed that wood and woodlands add very greatly to the picturesque character of a romantic country, and that they are absolutely essential as a chief ingredient in forming the beauty of a tamer landscape. Towards this end no single species of tree contributes so much as the fir tribe, the subject of this report. Whether we view them rising in majestic form from craggy steeps, and even crowning mountain tops—

> Aerial pines from loftiest steeps ascend,
> Nor stop till where creation seems to end;

or whether we wander among them where they deck the sides of gentler uplands, reminding us, as we listen to the continuous whisperings of their leafy tops, of Milton's hymn—

> Wave your tops ye pines;
> With every plant, in sign of worship, wave;

or whether we look upon them as solitary pines, with less of a bare stem, and more of full and expanded branches, each

> By a brook side or solitary tarn,
> How she her station doth adorn; the pool
> Glows at her feet, and all the gloomy rocks
> Are brightened round her;

they are ever full of beauty, full of interest, full of freshness. Trees yield much to the poetry of country life. Their varied forms and foliage, and the lights and shadows which they exhibit, fill the eye and gratify the taste of the painter; their various outline and

grouping, colour and motion, interest and delight the minds of all; they greatly strengthen the ties of man to his own particular spot of earth, and thus inspire and invigorate patriotism; in short, they excite into action many of the finer impulses of the mind, tending to elevate and improve, as well as to gratify, those who are the disciples of their study and culture.

REPORT OF AN EXPERIMENT ON GROWING TURNIPS WITH DIFFERENT MANURES ON THE FARM OF CRAIGLOCKHART.

By Mr Alexander Scott.

The turnips were Skirving's purple-top yellow; they were sown on the 11th June 1855, and lifted and weighed on the 22d of November. The soil is black loam, lying on whinstone rock, naturally dry, of medium fertility, and inclined to grow a small quantity of straw.

Manure applied.	Per acre.		Cost per acre.	Produce per acre.		Value of crop per		Value of crop less cost of manure.
	cwt.	price.	£ s. d.	tons.	cwt.	ton.	acre.	£ s. d.
Guano, . . .	4½	11/4½	2 11 2¼	20	4½	10/	£10 2 3	7 11 0¾
Phosphate of lime,	4½	8/4⅕	1 17 6$\frac{9}{10}$	19	16	...	9 18 0	8 3 5$\frac{1}{10}$
Bone-dust, . .	4½	8/6	1 18 3	18	18¼	...	9 9 1½	7 10 10½

From the time the turnips brairded until the end of August the different lots could scarcely be distinguished from each other. About that period the whole began to suffer from want of rain, and became much mildewed; however, those grown with guano suffered less than the others, and from that time until the end of October distinctly marked themselves by a greener and fresher appearance, which, although to a less extent, continued until they were lifted.

The turnip tops have been all left on the ground to be ploughed in, and it is intended to sow the field with wheat, and next season ascertain the result of the wheat crop.

The following is an analysis of the manures employed, as furnished by Professor Anderson, Chemist to the Highland and Agricultural Society of Scotland:—

	Guano.	Bone-dust.		Phosphate of lime.
Water,	14.22	8.10		8.48
Organic matter and ammoniacal salts,	50.63	38.70		3.95
Phosphates,	26.54	44.50	Soluble,	11.54
			Insoluble,	16.69
Alkaline salts,	7.38	...		2.42
Sulphate of lime,	...	...		41.62
Sulphuric acid,	...	...		8.86
Carbonate of lime,	...	7.14		...
Sand,	1.23	1.56		6.44
	100.00	100.00		100.00
Ammonia,	16.15	4.96		1.21
Phosphoric acid in alkaline salts equal to 5.11 phosphate of lime,	2.34			

REPORT ON THE MACHINERY BEST ADAPTED TO PRODUCE, BY ONE OPERATION, OR AN UNINTERRUPTED SERIES OF OPERATIONS, PIPES OR TILES FROM CLAY IN A ROUGH STATE.

By Mr Robert Boyle, Ayr.

[Premium — Twenty Sovereigns.]

So much has been said in previous years regarding the capabilities of pipe and tile machines, and so many attempts have been made to bring out new inventions, or to improve upon the old, that anything now suggested as calculated to simplify the process, will, I have no doubt, be considered by many persons as altogether superfluous. Still, to the minute observer much remains to be accomplished ere the machines designed for the manufacture of pipes or tiles can be regarded as complete, or can be classed with the inventions and improvements which of late years have marked the progress of other implements. Since the ingenious invention of the Marquess of Tweeddale, down to the present day, very little has appeared with the thorough stamp of originality; mostly all are copies, with very slight modifications in their minor details.

At the recent English Agricultural Society's Show, the prize was awarded to Scragg's machine, it being nearly in the same crude state as when it was ushered in a good number of years ago. And to the machine exhibited at the Highland Society's Show, lately held at Berwick, the same remark is applicable. I do not mention this in order to disparage any of these machines—far from it; I only mean to show that nothing *progressive* has appeared for a

number of years: and what makes this circumstance the more remarkable is the fact that so much remains to be accomplished in this department.

The Highland and Agricultural Society of Scotland has year after year perseveringly offered a premium for a machine adapted to simplify, economise, and render efficient the manufacture of draining materials, by milling the clay, screening it, and moulding the pipes or tiles simultaneously, and by a continuous process; the Directors of that Society knowing well that, until this desideratum be supplied, nothing like perfection can be attainable.

I would, therefore, in accordance with the wish expressed by the Society, attempt to lay down a method whereby the desired object can be simply and cheaply accomplished.

In the first place, then, a plain substantial oblong wooden box is made, 7½ feet in length, 2½ feet in width, and 2½ feet in depth. This box is fixed in a horizontal position at the end of the drying-shed, next the horse or steam power, or set on a frame having four wheels to act as a locomotive in traversing the sheds. At the one end of this box, and in the interior thereof, a pug-mill is placed, 4 feet long, of the usual construction, only the knives are fitted closer to one another on the spindle, the power being conveyed from the engine or horse-walk by lying and upright shafts, bevelled wheels, &c.

At the termination of this 4-feet spindle, a strong partition of wood is run through the box, having an aperture sufficiently large, through which the clay is forced by the inclination given to the knives, as in common clay-mills. Immediately behind this aperture are fixed two horizontal metal rollers, one foot in diameter, made to revolve in contrary directions, and placed so as to catch in their tight embrace the wedge of clay as it issues from the aperture in the partition between the rollers and the clay-mill. The wedge of clay, embraced as it is by these two metal rollers, will of necessity progress forward, in a steady and sure manner, in the exact proportion as the cylinders revolve. Immediately behind the revolving rollers there is a small chamber, at the front of which is fixed a screen plate, perforated with round holes, not less in diameter than the thickness of pipe wanted, through which the clay is expressed by the continuous and onward movement of the rollers.

In all former attempts to express clay through a screen plate by the action of a pug-mill, or by the assistance of a screw, the pressure was found to be inadequate as an expeller through such minute perforations as those required to cleanse clay; but with the revolving metal rollers no retardation can take place, for so long as the rollers revolve, an onward pressure of the clay must be the inevitable result, there being no possibility of any retrograde movement. By this process the clay is thoroughly purged from

all extraneous matter, the refuse being left in the chamber, which is situated between the rollers and the screen-plate.

To empty this chamber of stones, roots, &c., and to prevent the screen-plate from being choked, the following simple operation is performed: An opening is made on the top of the box the exact width of the chamber, secured by a lid acting on hinges, and which can be lifted up and put down at pleasure. Immediately below this chamber, and in the bottom of the box, a similar hole to the one above is left, also secured by a strong lid and hinges. These lids have each two strong bars and a catch, and can at requisite intervals be opened; all the debris therein collected being pushed down from above, thus descending through the aperture below in an easy and expeditious manner. The lids are then secured into their former places, and the work again resumed, the whole operation being performed in a few minutes.

In the front of the screen-plate are placed other two rollers similar to the first pair, also revolving in contrary directions, which receive the clay in their embrace as it protrudes through the perforated holes of the screen-plate. The clay, thus propelled forward by the action of the rollers, is received into a small chamber, so that it may be properly consolidated before entering the dies, which are placed in front thereof. Thus, in a very simple and efficient manner draining pipes or tiles are produced, the clay being taken from the pit, put into the box at one end in its crude state, and propelled forward by easy and short stages without intermission, till it exudes from the other end in the shape of a perfectly formed tube, and conveyed from thence on a frame ready to be cut off into proper lengths by any of the methods now in use, then transported by the boys at once into the drying shelves.

The great novelty in this machine is in the application of the revolving cylinders, they being used solely as the mode of propelling the clay through the screen-plate, which they accomplish in a perfect manner.

A doubt may arise in the minds of some, whether the space which is appropriated for the milling of the clay would be adequate for properly amalgamating the raw material, being so much less than the common pug-mills; but 4 feet of a spindle, and that spindle thickly clad with knives, will be found amply sufficient, as, immediately following the milling process, the clay is further pulverised by the great compression given to it in passing through the first pair of rollers; then being detached by the action of the screen-plate, and again compressed by the action of the second pair of rollers, the clay enters the dies, having great density, and as fine as silk. With this variation in the internal machinery of the box, the clay is brought to a more regular consistency than could be accomplished by any one uniform method, however prolonged.

The length of the box containing the whole apparatus is 7½ feet,

and is subdivided as follows: 4 feet for the length of spindle and knives, 4 inches for the partition and bottom of the mill, 12 inches for the first pair of rollers, 6 inches for the first chamber, 1 inch for the thickness of screen-plate, 12 inches for the second pair of rollers, 6 inches for the second chamber, and 1 inch for the die-plate.

The entire box, if placed on a frame with wheels, can be transported, if necessary, from point to point in the drying sheds, and the power conveyed from the engine by lying and cross shafts, pitch-chain, &c.

The whole expense of the box, with all its internal machinery, will not exceed £20 or £25; it can be easily driven by two-horse power, attended by two men and three boys, and will produce ten thousand properly formed pipes in ten hours.

I would have sent a model of the machine along with this essay, but having learned from experience that these diminutive articles invariably fail to convey any satisfactory evidence of their utility, I considered that a *minute description of all its parts* would be fully more intelligible to practical men.

PROCEEDINGS IN THE LABORATORY.

By Thomas Anderson, M.D., Regius Professor of Chemistry in the University of Glasgow, and Chemist to the Society.

I. ON SPECIFIC GRAVITY AS A CHARACTER FOR DETERMINING THE VALUE OF DIFFERENT CROPS.

(*An Address delivered at the Monthly Meeting of the Society on the* 19*th of Dec.* 1855.)

The great fundamental object of agriculture is to produce the largest possible quantity of food for the support of the population, and there are three different modes by which it may be attained. 1st, The breadth of land under cultivation may be increased,—an operation which, in thinly-peopled countries, can be effected without any increase in agricultural skill, but in the midst of a dense population resolves itself into the improvement of inferior soil, and demands an intelligent prosecution of the art; 2d, An increased quantity of produce may be raised from the land already under cultivation; and, 3d, The quality of the produce may be improved, the soil being made to yield a crop containing less than the average quantity of innutritious, and more than the average of nutritious constituents, so that, though its bulk remains unchanged, the quantity of real nutriment it supplies is increased.

The tendency of agricultural improvement has, in this country at least, lain chiefly in the direction of the two former methods, and comparatively few attempts have been made to improve the quality of our crops. It is true that new varieties of different grains and roots are constantly offered to the farmer as improve-

ments upon those formerly in use, and yielding a produce of higher quality; but the alleged superiority is often problematical, rarely beyond dispute, and still more rarely does it happen that any principle has been called into action in producing the improvement. Indeed, the great majority of the most approved varieties, both of grains and roots, have had a purely fortuitous origin; and in proof of this statement it is only necessary to recall to mind the fact, that the three varieties of wheat most extensively cultivated in Scotland were chance discoveries. Hunter's, which for half a century has been more largely used than any other, was raised from a single plant found by the roadside in Coldingham Moor; Fenton, from three ears which grew in an old quarry; and Hopetoun, from a single plant found near Drem. In these cases there was no attempt to *produce* an improved quality, but the plants, having been observed to possess the characters most approved by farmers, were simply used as the stock from which a new variety was propagated, and they have retained their characters nearly or altogether unchanged for a very considerable period. It is to be observed also, that the superiority accorded to these varieties is scarcely due to their yielding a grain of superior nutritive value, but is rather dependent on the amount of produce, their value lying in the number and size of the pickles yielded by each ear, and the shortness and stiffness of the straw, which prevents lodging, and the consequent deterioration or destruction of the grain; so that the improvement in these cases principally consists in the production of a larger amount of crop, and really falls under the second of the three methods of improvement to which we have alluded. Yet that there are differences in the quality of different varieties of grains and roots, and that too of a very conspicuous character, is a fact consistent with universal experience; and it is equally important to discover the means by which the highest quality, as well as the largest quantity, can be obtained with certainty. It may be urged that both go together, and this is no doubt frequently the case, though far from invariably; and it is obviously not only possible, but in some instances even probable, that where the quantity is largely increased there may be a gain in bulk without a correspondent increase of the more nutritive matters, which experience has shown to be those whose production is dependent upon the constituents of the food of plants which nature supplies most charily, and art finds the most costly for her to obtain.

It is clear, that if we wish to produce improved varieties of our grains and roots, what is most essentially required is some readily-applicable method of determining their quality with precision. The most precise means is obviously to be found in their chemical analysis, but this is necessarily a method which can be employed only to a very limited extent, and in many instances is totally inapplicable. In the case of a grain, for instance, each

individual seed perpetuates its own peculiarities, and the object to be had in view is to select from a large number those individual seeds which have the highest quality. Now, chemical analysis will determine this quality, but it can only afford the means of making the selection indirectly, by showing that there are particular distinctive marks by which the good seeds may be at any time recognised and distinguished from the indifferent or the bad. Thus, for instance, suppose that in any sample of grain the rounder and plumper pickles had been separated from those which were long and shrivelled, and chemical analysis disclosed the fact that the former possessed a higher nutritive value than the latter, it would be possible, by careful selection, to procure seeds which would yield a produce of higher than the average quality. But the peculiarity in form of a grain is a character which admits of very loose and imperfect observation, and if anything is to be done in this way, some plan admitting of greater precision must be discovered. The character which is most easily observed, and has been long employed in the arts for determining the relative values of different substances, is their specific gravity; and as it has recently been brought prominently under the notice of the farmers, by the interesting experiments of the Marquess of Tweeddale on the specific gravity of turnips, I have thought that the whole question of the value of that character, for determining the nutritive properties of different crops, was worthy of being more fully considered than it has yet been. It cannot be doubted, that if applicable to one crop it must be so to others also; but it is to be observed that there are various points affecting the conclusions to be drawn from it in different cases, and I propose, therefore, to consider it in regard both to grains and roots.

The relation of weight to bulk has long been employed as a mode of determining the value of corn crops, and the weight per bushel is an element which is never neglected in their sale; but a very wide distinction is to be drawn between this character and specific gravity, for the latter represents the weight of a solid mass, as compared with that of an equal bulk of water, while the former gives that of a quantity of small particles filling the bulk; and this quantity is dependent, not upon the specific gravity of each of these particles, but very much upon their form, and the amount of interstices they leave between them. Now, it has been determined mathematically, that of all forms bounded by curved lines, spheres are those which leave the smallest quantity of interspaces. They pack better than any other form; so that, for example, if we were to fill a bushel-measure with shot, and then recast it into egg-shaped shot, the bushel would no longer hold it. When, therefore, we weigh a bushel of wheat, we do not determine its specific gravity, but arrive at a number which must be influenced by the form of the grain and many other circumstances;

and we should anticipate, *a priori*, that of two samples of wheat of the same specific gravity, that which had the form most nearly approaching to the sphere would have the greatest weight per bushel. Of course, it is easy to see that the weight per bushel must be affected in many other ways, so that its relation to the nutritive value of the grain becomes a very complicated question, and grave doubts may be entertained as to whether it is a trustworthy indication of value, and whether it ought not to be replaced by a determination of the specific gravity. My attention was forcibly directed to this point some time since, and I had proposed to submit it to examination; but meanwhile, an inquiry into this subject by a distinguished French chemist, M. Reiset, appeared, which embraced almost everything I required, and caused me at once to abandon my intention. His experiments have so intimate a connection with those I have made on the turnip, that it is necessary that I should commence with some account of them.

At the commencement of the inquiry, it appeared to be of importance to ascertain how far the mode of measuring may influence the result. We know, of course, that, when the measure is shaken while filling, it will weigh heavier than if it be kept still; and Reiset has shown that the difference may be as much as 8 per cent: the cause, of course, being, that the individual particles are more closely packed. In actual practice, the measure is always kept at rest; and in this case the packing is dependent on other circumstances, of which the smoothness and dryness of the grain are most important. A rough or corrugated grain generally weighs lighter than a smooth one, because the asperities of the different particles catch into one another, and prevent the grains coming into the state of greatest proximity. For the same reason, damp grain weighs light, for the pickles do not so readily slide over one another as they fall into the measure, and therefore do not come into the closest possible proximity. So far we have illustrations of circumstances which affect the weight of different samples per bushel; but when we come to compare this with the actual specific gravity, we find that the results are very remarkable. Reiset has determind the specific gravity by means of an instrument called a volumenometer, and the following table contains the results of his experiments on different varieties of wheat. The first column gives the specific gravity; the second, the weight per bushel in pounds and decimals of a pound; and the third, the weight which a bushel would have if it could be filled absolutely full of the wheat —that is to say, without any interstices between the grains:—

Variety.	Specific gravity.	Weight per bushel.	Weight which a bushel would have if there were no interstices between the grains.
		lb.	lb.
1. Petanielle noire, ...	1.290	59.2	103.2
2. English white wheat, ...	1.347	61.4	107.8
3. Wheat grown at Ecorchebœuf in 1850,	1.350	59.9	108.0
4. La Charmoise wheat, ...	1.350	61.9	108.0
5. Albert wheat (3d year after importation),	1.358	63.3	108.6
6. Barker's stiff straw (imported 1851), .	1.371	63.4	109.7
7. Russian white wheat, ...	1.378	65.3	110.2
8. Herisson, ...	1.380	63.6	110.4
9. Richelle de Naples, ...	1.381	64.0	110.5
10. Victoria, ...	1.381	59.6	110.5
11. Spalding grown at Echorchebœuf in 1851,	1.382	62.6	110.6
12. Victoria, do. do. do.	1.384	62.8	110.7
13. Xeres (very hard), ...	1.384	64.3	110.7
14. Russian white wheat (seventh year after importation), ...	1.385	63.6	110.8
15. Wheat grown near Pontleroy, . .	1.388	62.0	111.0
16. Sicilian wheat, ...	1.390	64.2	111.2
17. Nonette, ...	1.391	64.0	111.3
18. Richelle de Grignon, ...	1.396	64.5	111.7
19. Albert (imported in 1851), ...	1.398	65.2	111.8
20. Polish wheat (very hard), ...	1.407	59.7	112.6
Mean, . .	1.374	62.7	109.9

In running the eye over this table, we are at once struck with the fact that, contrary to the generally received opinion, there is no connection between the specific gravity and the weight per bushel. We find, in fact, that the highest specific gravity—1.407—corresponds to one of the lowest weights per bushel; and, on the other hand, the Russian white wheat (No. 7), which is 65.3 lb. per bushel, has a low specific gravity; and this difference was obviously due to the form of the two grains, for the Polish wheat was unusually long, and the Russian as remarkably round.

But the most remarkable effect on the weight per bushel is produced by the quantity of moisture in the grain. It appears that each grain has a normal per-centage of water, which it retains unchanged when preserved under ordinary circumstances, and the addition to and abstraction from this quantity have both the effect of lowering the bushel weight of the grain. This is remarkably seen in the following table, in which a grain containing normally 16.11 per cent of moisture was gradually dried, and its specific gravity and bushel weight determined at intervals:—

Per-centage of water.	Specific gravity.	Weight per bushel.	Amount of water lost by a bushel.
		Lb.	Lb.
16.11	1.398	65.2	...
14.93	...	64.8	0.76
14.00	...	64.4	1.37
10.60	... .	63.5	3.59
7.94	1.409	64.2	5.32
7.24	1.420	63.8	5.78

We observe here that the weight per bushel diminishes gradually until the moisture is reduced to 10.6 per cent, when it is nearly 2 lb. per bushel lower than at first; but by continuing to dry the grain its bushel-weight rises, although it never comes up to its original quantity.

An addition to the normal quantity of water produces a similar effect; for when Spalding wheat was exposed in an atmosphere saturated with humidity, both its specific gravity and its bushel-weight were found to diminish. We give the numerical results of the experiment, the first line showing the per-centage of moisture, specific gravity, and bushel-weight of the grain in its normal state; the other four, after the absorption of water :—

Water per cent.	Specific gravity.	Bushel-weight.
		Lb.
14.69	1.382	62.6
15.82	...	61.8
16.96	1.375	61.6
19.29	1.360	59.1
31.17	...	53.8

It thus appears that the absorption of 16 per cent of moisture had reduced the bushel-weight of this grain by nearly 9 lb. On exposure to the air the water thus absorbed is rapidly lost, and in two days it is again reduced to its normal quantity, but the wheat never regains its original specific gravity and bushel-weight; and in this case the former remained at 1.361, and the latter at 59.2 lb. An important practical lesson is deducible from this experiment, for it shows that if a grain be once allowed to become moist, it suffers a permanent deterioration. It retains to a certain extent its swollen condition, and by the reduction in its weight per bushel its market value is materially diminished.

So far, then, these experiments show that the specific gravity of wheat varies within pretty wide limits, and that it has no relation

to the weight per bushel. Further, that the latter is liable to remarkable modifications dependent on the state of moisture of the grain, from which fact we learn two practical lessons of importance: first, that if the crop be allowed to become wet, after being cut, a permanent deterioration of its bushel-weight is the consequence; and, second, that the practice of kiln-drying grain has the same effect. These matters are, in the present state of practice, of no small importance, for the quality of grain is, in part at least, determined by its weight per bushel. But we have seen that this character is entirely unconnected with the specific gravity of the grain, and the question comes to be, which of the two affords the most accurate means of fixing its quality? In determining this point it becomes necessary to resort to analysis, and it may be well to remind the reader that experiment has shown that the nutritive value of any grain or other vegetable food is largely dependent upon the quantity of nitrogenous or protein compounds contained in it, and can be most accurately determined by ascertaining the richness of the grains in these substances. This is done in the following table, where the first column gives the quantity of water, and the other three the ash, nitrogen, and protein compounds in the dry grain:

Variety.	Water in normal state.	100 Parts of the dry wheat contained—		
		Ash.	Nitrogen.	Protein compounds.
1. Petanielle noire, ...	14.10	2.14	1.71	10.68
2. English white wheat, . . .	14.47	1.88	1.88	11.75
3. Wheat grown at Ecorcheboeuf in 1850,	15.90	1.89	2.03	12.68
4. La Charmoise wheat, . . .	14.97	2.10	1.87	11.68
5. Albert wheat (3d year after importation),	15.64	1.92	1.97	12.31
6. Barker's stiff straw (imported 1851),	16.51	1.88	1.83	11.43
7. Russian white wheat, . . .	15.00	1.97	2.03	12.68
8. Herisson, ...	13.48	2.19	2.87	17.93
9. Richelle de Naples, . . .	14.13	2.11	2.23	13.93
10. Victoria, ...	15.49	2.02	2.45	15.31
11. Spalding (grown at Ecorcheboeuf, 1851),	14.69	2.03	1.98	12.37
12. Victoria, do. do. do.	13.27	1.92	1.89	11.81
13. Xeres (very hard), . . .	13.60	1.91	1.94	12.12
14. Russian white wheat (third year after importation), ...	13.65	1.77	1.93	12.06
15. Wheat grown near Pontleroy, .	12.81	1.61	2.00	12.50
16. Sicilian wheat, ...	14.25	2.11	2.20	13.75
17. Nonette, ...	13.11	1.98	2.09	13.05
18. Richelle de Grignon, . . .	14.11	1.87	1.99	12.44
19. Albert (imported 1851), . .	16.11	2.13	2.15	13.43
20. Polish wheat (very hard), . .	12.20	2.18	2.61	16.31
Mean, . .	14.37	1.98	2.08	13.01

If, now, we compare these results with the bushel-weight and specific gravities of the same grains contained in the table at page 178, we find that the per-centage of nitrogenous matter is in no way related to the weight per bushel. For example, the Russian white wheat, weighing 65.3 lb. per bushel, and the heaviest examined,

contains only 12.68 per cent of albuminous matters, which is rather under the average, and is exactly the same as that in the wheat grown at Ecorchebœuf in 1851, of which the weight is only 59.9 lb. per bushel; and the Polish wheat, which is among the richest in nitrogenous matters, is also among the lightest examined. On the other hand, a distinct relation appears to subsist between the specific gravity and the protein compounds. Some remarkable exceptions are no doubt to be found, but, taking the mean of those having a low and a high specific gravity separately, the advantage in nitrogenous matters is clearly in favour of the latter.

Specific gravity is thus undoubtedly an index of the nutritive value of different varieties of wheat; and though its indications are rough, and in some degree imperfect, it is a character worthy of a certain amount of consideration, although in the present state of matters it can only be relied upon to a limited extent. If wheat bore a price dependent on the quantity of nutritive constituents, *i.e.*, of protein compounds it contained, the specific gravity, or, better still, the per-centage of nitrogen, would be important, nay, indispensable characters; but in actual practice, the nutritive value of a wheat is a character in no degree considered in estimating its price; in point of fact, the purchaser takes into consideration only the quantity and quality of the flour it will yield. For the former purpose, he selects a thin-skinned wheat, judging partly by its appearance, but very much also by his knowledge that certain varieties have been found by experience to yield a larger proportion of flour suited for the baker than others, and that the climate in which it has been grown has an effect upon the thickness of the skin. In estimating the latter he looks to colour, and not to nutritive value. So far, indeed, is the quantity of protein compounds from being an indication of the price which will be paid for any sample of wheat in the market, it is rather the reverse; for the hard wheats, which are richer in nitrogen, and consequently most nutritive, produce a flour of indifferent colour, and consequently bear an inferior price.

It is manifest that in this way the sale and purchase of grain is founded on an erroneous principle, but it is a principle dependent upon the prejudices of the consumer. So long as the public select flour, not by its nutritive properties, but its colour, that is to say, so long as they continue to sacrifice substance for appearance, it is obviously the interest of the farmer to produce a wheat of low specific gravity, by doing which he gains as much as the consumer loses. Of the extent to which the former loses, some idea may be formed by reference to the tables contained in the preceding pages. When, for instance, a comparison is made between the first and last wheat, it appears that a crop of six quarters of the Petanielle noire will contain 303 lb. of albuminous compounds, and the same quantity of Polish wheat no less than 463 lb., and if the price of

the former were fixed at 60s., that of the latter ought to be almost exactly 90s., although in practice no such difference would exist. It is clear, therefore, that there is no inducement for the farmer to produce a grain rich in albuminous compounds; on the contrary, his interest is to obtain those which contain least, for they not only, as a general rule, produce a finer, *i.e.*, a whiter flour, but they exhaust the soil to a smaller extent. In fact, the 160 lb. of excess of albuminous matters in six quarters of Polish wheat contain 25 lb. of nitrogen, and to yield this quantity it would be necessary to add to the soil 2¾ tons of farmyard manure, or nearly 2 cwt. of Peruvian guano. As far, therefore, as human food is concerned, it is important to produce grain of low specific gravity, but that does not show that that character is an erroneous estimate of quality; on the contrary, the ignorant prejudice of the public induces them to select bread of inferior nutritive value, because it pleases the eye; but in dieting large establishments, such as prisons and workhouses, where the amount of nutriment is generally very carefully and closely apportioned to the requirements of the inhabitants, it becomes a character of no small moment. Still more is this the case with cattle, where the abundance of nutritive matters becomes the sole and only question.

In all these observations the distinction between specific gravity and weight per bushel must not be misapprehended. The former enables us to estimate, with a certain degree of precision, the nutritive value of a grain, the latter does not; but, so long as the whiteness of the flour, which any wheat will yield, regulates its price, then the weight per bushel is a valuable character to the farmer, for wheats with plump and well-rounded grains, which are those that weigh heaviest in the bushel, contain also the largest quantity of starch, and yield the whitest flour.

If we turn now to the specific gravities of roots, it appears that very little has as yet been done. Practical men have no doubt entertained the opinion that hard and heavy turnips, that is to say, turnips which, when weighed in the hand, appeared heavy in proportion to their size, were to be preferred, but the accuracy of the opinion had never, so far as we know, been subjected to the test of experiment, either by comparing the results of feeding or by analysis. German chemists, with special reference to the value of potatoes for the production of spirit, a branch of manufacture largely pursued in Germany, have determined the relation of specific gravity to the quantity of starch they contain, and though this gives some idea of their nutritive value it is but an approximation. The most recent, and probably the most accurate, experiments are those of Pohl, who determined the starch and total solids in potatoes of different specific gravity. His results are as follows:—

Specific gravity.	Dry matter per cent.	Starch per cent.	Specific gravity.	Dry matter per cent.	Starch per cent.
1.090	23.84	16.38	1.106	27.54	20.05
1.091	24.09	16.81	1.107	27.97	20.45
1.093	24.57	17.11	1.108	28.10	20.69
1.094	24.98	17.52	1.110	28.99	21.32
1.099	25.93	18.43	1.116	29.50	21.95
1.101	26.45	18.98	1.123	31.64	24.14

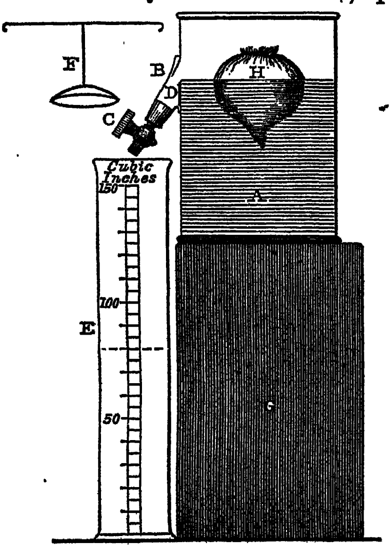
These experiments are defective in one particular, which, though not necessary for the purpose for which they were made, is essential to the exact estimation of their nutritive value. There are no determinations of the albuminous compounds. As it appears, however, that the quantity of starch and solid matters have both gone on increasing very rapidly, it seems a reasonable assumption that these nitrogenous matters have increased *pari passu;* and if this be the case, it is at once obvious that specific gravity must be a character of excessive importance in estimating the value of potatoes. In point of fact, its importance has been admitted in practice, and a patent is in existence founded on this very character. The potatoes are divided into two or more qualities by the use of a solution of salt of a certain specific gravity: all those that sink in it—that is, have a higher specific gravity than the fluid—are considered as of good quality, and bear a higher price, while those which float are rejected as inferior. The importance of the character is obvious from the experiments just quoted; for if we assume the quantity of dry matter to express the nutritive value of the different potatoes, a system which, though not absolutely correct, is at least an approximation to the truth, it is obvious that the purchaser of 100 tons of potatoes, having a specific gravity of 1.123, gets in exchange for his money as much nutriment as would be contained in 132 tons of specific gravity, 1.090.

The specific gravity of the turnip has, for the last few years, formed the subject of a very extensive series of experiments on the part of the Marquess of Tweeddale, undertaken with the view of permanently improving the quality of that crop. It is not my object here to enter upon the particulars of these experiments. It will suffice for my present purpose to observe, that their principle consists in selecting the turnips of highest specific gravity, which are then planted out for seed, and the seed saved from them is found to produce turnips of specific gravity above the average. From this crop the specifically heaviest bulbs are again selected, and their produce is treated in the same manner, and thus, after several years, a crop is obtained materially higher in specific gravity than

that with which the experiments started. The question which remained for determination was to ascertain whether an increase in specific gravity really indicated an increase in nutritive value. For the determination of this point I have made analyses of a number of turnips grown by the noble Marquess, the results of which I now propose to detail.

Some preliminary information is required as to the mode in which the specific gravities were ascertained, and the analyses conducted.

The specific gravity is determined by means of an apparatus contrived by Mr Stevenson, philosophical instrument maker, Lothian Street, Edinburgh. It consists of two cylindrical vessels of glass; one is of sufficient size to contain the largest turnip; and at one side, near the upper part, it has an aperture directed downwards, and furnished with a stopcock. The other vessel is long and narrow, and is graduated on one side into pounds and ounces, so that it indicates the weight of any quantity of water which may be poured into it. The mode in which the specific gravity is determined depends upon whether the turnip be heavier or lighter than water. The larger wide vessel is first filled with water to a height above the level of the stopcock, which is then opened, and the superfluous water allowed to flow out. When it has ceased dropping, the graduated cylinder is placed under the stopcock, the other vessel being put on a box or stool sufficiently high to admit of this being done. The turnip of which the specific gravity is to be determined is then carefully introduced into the water, which immediately begins to escape by the aperture in the side. If the turnip floats on the water, then that which flows out is, according to a well-known hydrostatic law, equal in weight to the turnip, and is at once determined by the graduation on the long cylinder. The turnip is then pushed under the surface, either by the point of the finger, or, better still, by means of a brass ring attached by a stout wire to a cross piece which fixes on the top of the cylinder. An additional quantity of water is thus expelled, and the weight now indicated on the measure is that of a quantity of water equal in bulk



to the turnip. There are thus obtained, the weight of the turnip itself, and that of an equal bulk of water, which are the data requisite for the determination of its specific gravity. If the turnip is heavier than water, the instrument is only capable of determining the latter quantity, and the weight of the turnip must be got by actual weighing. The specific gravity of the juice was obtained by the use of the 1000 grain bottle. The specific gravities of the turnips were determined at Yester, those of the juices by myself, when they were expressed for analysis.

The mode of analysis claims but little notice, as it was substantially the same as that adopted in my previous analysis, published in the *Transactions of the Highland and Agricultural Society*, New Series, vol. v. The determination of the pectic acid and oil were omitted, as previous experience had shown that they were of little importance in estimating the nutritive value of the roots; but instead of these, the specific gravity of the juice and the quantity of dry matters contained in it were ascertained. The analyses consist of two series, the first made last autumn, and the second on turnips which had been preserved during the winter. The analyses of the latter series are distinguished by an asterisk. The details are given in the following pages:—

FIRST SERIES.

No. 1.—Green Top White.

Yester Mains.—*Clay soil.*

Specific gravity,		0.841.
Fibre.	Pectic acid and lignine,	173.5
	Protein compounds,	12.0
	Ash,	8.5
	Total fibre,	194.0
Juice.	Water,	9456.0
	Protein compounds,	51.0
	Sugar, gum, &c.,	299.0
		10,000.0

Ash,	57.0
Phosphates,	7.0
Phosphoric acid in alkaline salts,	3.0
Nitrogen in fibre,	1.9
Do. in juice,	8.1

Specific gravity of juice,	1.025
Dry matter in 100 parts of juice,	5.63

No. 2.—Green Top White.

Danskin.—*Light soil.*

Specific gravity,		0.894.
Fibre.	Pectic acid and lignine,	182.0
	Protein compounds,	10.3
	Ash,	10.7
	Total fibre,	203.0
Juice.	Water,	9400.0
	Protein compounds,	33.6
	Sugar, gum, &c.,	363.4
		10,000.0

Ash,	65.0
Phosphates,	7.0
Phosphoric acid in alkaline salts,	
Nitrogen in fibre,	1.6
Do. in juice	5.4

Specific gravity of juice,	1.020
Dry matter in 100 parts of juice,	4.71

No. 3.—Purple Top Yellow.

YESTER MAINS.—*Medium soil.*

Specific gravity, . 0.866.

Fibre.	Pectic acid and lignine, .	179.0
	Protein compounds, .	14.0
	Ash, . . .	9.0
	Total fibre, .	202.0
Juice.	Water . . .	9452.0
	Protein compounds, .	47.5
	Sugar, gum, &c., . .	298.5
		10,000.0

Ash, . . .	49.0
Phosphates, . .	6.0
Phosphoric acid in alkaline salts, .	.9
Nitrogen in fibre, .	2.23
Do. in juice, .	7.57

Specific gravity of juice, .	1.025
Dry matter in 100 parts of juice,	4.90

No. 4.—Purple Top Yellow.

YESTER.—*Clay soil.*

Specific gravity, . 0.904.

Fibre.	Pectic acid and lignine, .	191.7
	Protein compounds, .	18.0
	Ash, . . .	10.3
	Total fibre, .	220.0
Juice.	Water, . . .	9329.0
	Protein compounds, .	93.0
	Sugar, gum, &c., . .	358.0
		10,000.0

Ash, . . .	67.0
Phosphates, . .	7.0
Phosphoric acid in alkaline salts, .	2.0
Nitrogen in fibre, . .	2.87
Do. in juice, .	10.23

Specific gravity of juice, .	1.030
Dry matter in 100 parts of juice,	6.32

No. 5.—Green Top Yellow.

YESTER.—*Clay soil.*

Specific gravity, . 0.952.

Fibre.	Pectic acid and lignine, .	201.7
	Protein compounds, .	13.3
	Ash, . . .	9.0
	Total fibre, .	224.0
Juice.	Water, . . .	9245.0
	Protein compounds, .	56.0
	Sugar, gum, &c., . .	475.0
		10,000.0

Ash, . . .	41.0
Phosphates, . .	8.0
Phosphoric acid in alkaline salts, .	1.0
Nitrogen in fibre, .	2.12
Do. in juice, .	8.88

Specific gravity of juice, .	1.030
Dry matter in 100 parts of juice,	6.26

No. 6.—

Specific gravity, . 0.937.

Fibre.	Pectic acid and lignine, .	239.0
	Protein compounds, .	13.5
	Ash, . . .	10.5
	Total fibre, .	263.0
Juice.	Water, . . .	9257.0
	Protein compounds, .	73.7
	Sugar, gum, &c., . .	406.3
		10,000.0

Ash, . . .	72.0
Phosphates, . .	10.0
Phosphoric acid in alkaline salts, .	4.0
Nitrogen in fibre, .	2.15
Do. in juice, .	11.75

Specific gravity of juice, .	10.35
Dry matter in 100 parts of juice,	6.83

No. 7.—Swede.

YESTER.—*Medium soil.*

Specific gravity, . 1.015.

Fibre.	Pectic acid and lignine, .	187.8
	Protein compounds, .	10.5
	Ash, ...	7.7
	Total fibre, .	206.0
Juice.	Water, ...	9232.0
	Protein compounds, .	58.5
	Sugar, gum, &c., . .	503.5
		10,000.0

Ash, . . .	72.0
Phosphates, . .	7.0
Phosphoric acid in alkaline salts, .	1.0
Nitrogen in fibre, .	1.67
Do. in juice, .	9.33

Specific gravity of juice, . 1.037
Dry matter in 100 parts of juice, 6.72

No. 8.—

Specific gravity, . 0.911.

Fibre.	Pectic acid and lignine, .	251.2
	Protein compounds, .	13.8
	Ash, . . .	11.0
	Total fibre, .	276.0
Juice.	Water, ...	9269.0
	Protein compounds, .	40.2
	Sugar, gum, &c., . .	414.8
		10,000.0

Ash, .	43.0
Phosphates, . .	7.0
Phosphoric acid in alkaline salts, .	1.5
Nitrogen in fibre, .	2.20
Do. in juice, .	6.40

Specific gravity of juice, . 1.032
Dry matter in 100 parts of juice, 6.30

No. 9.—Purple Top.

YESTER.

Specific gravity, . 0.861.

Fibre.	Pectic acid and lignine, .	249.0
	Protein compounds, .	29.0
	Ash, . . .	28.0
	Total fibre, .	306.0
Juice.	Water, ...	9329.0
	Protein compounds, .	33.0
	Sugar, gum, &c., . .	332.0
		10,000.0

Ash, . .	49.0
Phosphates, . .	7.0
Phosphoric acid in alkaline salts, .	2.0
Nitrogen in fibre, .	4.70
Do. in juice, .	5.21

Specific gravity of juice, . 1.029
Dry matter in 100 parts of juice, 5.49

No. 10.—Green Top.

YESTER.—*Clay soil.*

Specific gravity, . 0.933.

Fibre.	Pectic acid and lignine, .	182.0
	Protein compounds, .	21.0
	Ash, . . .	18.0
	Total fibre,	221.0
Juice.	Water, ...	9554.0
	Protein compounds, .	44.0
	Sugar, gum, &c., . .	181.0
		10,000.0

Ash, . . .	43.0
Phosphates, . .	15.0
Phosphoric acid in alkaline salts, .	trace.
Nitrogen in fibre, .	3.25
Do. in juice, .	6.97

Specific gravity of juice, . 1.023
Dry matter in 100 parts of juice, 4.20

No. 11. — Green Top.

Danskine.—*Light soil.*

Specific gravity, . 0.884.

Fibre.	Pectic acid and lignine, .	254.0
	Protein compounds, .	13.0
	Ash, ...	13.0
	Total fibre, .	280.0
Juice.	Water, . . .	9115.0
	Protein compounds, .	83.0
	Sugar, gum, &c., . .	522.0
		10,000.0

Ash, ...	61.0
Phosphates, . .	11.0
Phosphoric acid in alkaline salts, .	.6
Nitrogen in fibre, .	2.10
Do. in juice, .	13.10

Specific gravity of juice, . 1.032
Dry matter in 100 parts of juice, 6.07

No. 12.—Swede.

Yester.—*Clay soil.*

Specific gravity, . 1.010.

Fibre.	Pectic acid and lignine, .	317.0
	Protein compounds, .	15.0
	Ash, . . .	11.0
	Total fibre,	343.0
Juice.	Water, . . .	9087.0
	Protein compounds, .	108.0
	Sugar, gum, &c., . :	462.0
		10,000.0

Ash, . . .	54.0
Phosphates, . .	10.0
Phosphoric acid in alkaline salts, .	1.0
Nitrogen in fibre, .	2.47
Do. in juice, .	17.19

Specific gravity of juice, . 1.042
Dry matter in 100 parts of juice, 8.27

No. 13.—Swede.

—*Clay soil.*

Specific gravity, . 1.015.

Fibre.	Pectic acid and lignine, . . .	247.0
	Protein compounds, . . .	19.0
	Ash, ...	12.0
	Total fibre, .	278.0
Juice.	Water, ...	9101.0
	Protein compounds, . . .	58.0
	Sugar, gum, &c., ...	563.0
		10,000.0

Ash, ...	50.0
Phosphates, . . .	10.0
Phosphoric acid in alkaline salts,	.3
Nitrogen in fibre, . . .	3.02
Do. in juice, . . .	9.28

Specific gravity of juice, . . . 1.037
Dry matter in 100 parts of juice, . . 7.48

SECOND SERIES.

No. 1.*—Tweeddale Purple Top.

YESTER.

Specific gravity, .954.

Fibre.	Pectic acid and lignine,	261.3
	Protein compounds,	12.9
	Ash,	12.8
	Total fibre,	287.0
Juice.	Water,	9054.0
	Protein compounds,	98.3
	Sugar, gum, &c.,	560.7
		10,000.0

Ash,	92
Phosphates,	12
Phosphoric acid in alkaline salts,	2.84
Nitrogen in fibre,	2.05
Do. in juice,	15.65

Specific gravity of juice, . 1.041
Dry matter in 100 parts of juice, 7.31

No. 2.*—Tweeddale Purple Top.

YESTER.

Specific gravity, .941.

Fibre.	Pectic acid and lignine,	271.5
	Protein compounds,	19.5
	Ash,	14.0
	Total fibre,	305.0
Juice.	Water,	9154.0
	Protein compounds,	84.0
	Gum, sugar, &c.,	457.0
		10,000.0

Ash,	82.8
Phosphates,	17.1
Phosphoric acid in alkaline salts,	.07
Nitrogen in fibre,	3.1
Do. in juice,	13.4

Specific gravity of juice, . 1.031
Dry matter in 100 parts of juice, 5.91

No. 3.*—Tweeddale Purple Top.

YESTER.

Specific gravity, .807.

Fibre.	Pectic acid and lignine,	370.1
	Protein compounds,	19.5
	Ash,	20.4
	Total fibre,	410.0
Juice.	Water,	9074.
	Protein compounds,	56.5
	Sugar, gum, &c.,	459.5
		10,000.0

Ash,	75.
Phosphates,	19.
Phosphoric acid in alkaline salts,	.15
Nitrogen in fibre,	3.1
Do. in juice,	9.0

Specific gravity of juice, . 1.036
Dry matter in 100 parts of juice, 6.84

No. 4.*—Tweeddale Purple Top.

YESTER.

Specific gravity, .850.

Fibre.	Pectic acid and lignine,	321.37
	Protein compounds,	22.
	Ash,	20.
	Total fibre,	363.37
Juice.	Water,	9260.
	Protein compounds,	53.3
	Sugar, gum, &c.,	323.33
		10,000.00

Ash,	77.
Phosphates,	12.
Phosphoric acid in alkaline salts,	.6
Nitrogen in fibre,	3.5
Do. in juice,	8.5

Specific gravity of juice, . 1.010
Dry matter in 100 parts of juice, 5.91

No. 5.*—Tweeddale Purple Top.

YESTER.

Specific gravity, .866.

Fibre.	Pectic acid and lignine,	312.5
	Protein compounds,	18.5
	Ash,	17.0
	Total fibre,	348.0
Juice.	Water,	9258.0
	Protein compounds,	84.5
	Sugar, gum, &c.,	309.5
		10,000.0

Ash,	68.
Phosphates,	9.8
Phosphoric acid in alkaline salts,	.14
Nitrogen in fibre,	2.95
Do. in juice,	13.45

Specific gravity of juice, 1.035
Dry matter in 100 parts of juice, 6.64

No. 6.*—Tweeddale Purple Top.

YESTER.

Specific gravity, .782.

Fibre.	Pectic acid and lignine,	283.5
	Protein compounds,	16.9
	Ash,	22.6
	Total fibre,	323.0
Juice.	Water,	9313.0
	Protein compounds,	33.3
	Sugar, gum, &c.,	330.7
		10,000.0

Ash,	72.0
Phosphates,	12.0
Phosphoric acid in alkaline salts,	.5
Nitrogen in fibre,	2.7
Do. in juice,	5.3

Specific gravity of juice, 1.028
Dry matter in 100 parts of juice, 8.87

In discussing these analyses, there are several points which merit consideration.

The most prominent is the fact, that all the turnips except the Swedes are specifically lighter than water, which is at variance with all our preconceived ideas. We know that sugar, gum, protein compounds, &c., when dissolved in water, increase its specific gravity, and that fibre and pectic acid are also heavier than that fluid; and hence we should be prepared to expect that all turnips should be heavier than water. The reverse of this, however, is the case; and on considering the cause of this phenomenon, it appeared to me that the most reasonable explanation was, that the cells of the turnip must contain air. In order to ascertain the accuracy of this explanation, a piece was cut from the most compact part of a yellow turnip, which showed not the least trace of sponginess, and immersed in water—a small weight being placed upon it, in order to retain it below the surface; the vessel containing it was then placed under the receiver of the air-pump, and the air exhausted. As soon as the pressure diminished, bubbles of air made their appearance on the surface of the turnip, and rose in rapid succession through the water, and continued to be given off abundantly for a considerable time. When the air was re-admitted into the receiver, the turnip had increased considerably in specific gravity, but it was found impracticable to

bring it up to that of water, apparently because the air could not be entirely removed from the cells in the interior of the mass. It is obvious that this peculiarity of the turnip introduces a considerable uncertainty into the determination of its specific gravity in the way indicated, for in doing so we are much in the same predicament as when the weight per bushel of a grain is taken, and in both cases the ratio of bulk to weight of substances containing interstices filled with air is determined. It is obvious that this must materially modify the inferences to be drawn from the specific gravities of turnips lighter than water, and possibly also to some extent of those heavier than that fluid. If, for instance, it were possible by any process to remove from a turnip a portion of the water it contains, and to replace it by air, its specific gravity would be diminished, but its value would be increased, because the purchaser would obtain in a ton, for his money, a smaller quantity of water and more nutritive matters. *A priori*, therefore, we should be entitled to expect that the specific gravity must be a character liable to some uncertainty; and the analyses which have been given indicate that though, on the average of the whole, it does to a certain extent represent their nutritive value, yet, in individual instances, it would lead to serious errors. This is more prominently brought out by the following table, in which the turnips are arranged in the order of their specific gravities, along with their per-centage of dry matters, and the quantities of nitrogen and protein compounds, calculated on 10,000 parts,—data which are of the greatest importance in estimating their nutritive value:—

I.—TABLE, showing the Quantity of Dry Matters, Nitrogen, and Protein Compounds, in the Turnips, arranged in the order of their Specific Gravity:—

Number of turnip.	Specific gravity of turnip.	Per-centage of dry matter in turnip.	Total nitrogen in 10,000.	Total protein compounds in 10,000.
6*	0.782	6.87	8.00	50.2
3*	0.807	9.26	12.10	76.0
1	0.841	5.44	10.00	63.0
4	0.850	7.40	12.00	75.3
9	0.861	6.71	9.91	62.0
5*	0.866	7.42	16.40	103.0
3	0.866	5.48	9.80	61.5
11	0.884	8.85	15.20	96.0
2	0.894	6.00	7.00	43.9
4	0.904	6.71	13.10	82.5
8	0.911	7.31	8.60	54.0
10	0.933	4.46	10.22	65.0
6	0.937	7.43	13.90	87.2
5	0.952	7.55	11.00	69.3
2*	0.941	8.46	16.50	103.5
1*	0.954	9.46	17.70	111.2
12	1.010	9.13	19.66	123.0
7	1.015	7.68	11.00	69.3
13	1.015	8.99	12.30	77.0

In examining this table, it is obvious that the specific gravity does not correspond in any way with the per-centage of total solids; for we find that the turnip, No. 3*, although of low specific gravity, has an amount of solid matter surpassed only in one case, while the lowest quantity of solids corresponds to a specific gravity which exceeds the average. Further, if the mean of the ten lowest and nine highest specific gravities be taken, the difference in the average quantity of total solids proves very small. The numbers stand thus:—

	Specific gravity.	Total solids.
Mean of the first ten, . .	0.855	7.01
Mean of the last nine, . .	0.963	7.83
Mean of the whole nineteen, .	0.906	7.41

So that a very considerable variation in specific gravity corresponds with a difference of no more than 0.8 per cent of total solids. It is different, however, when the nitrogenous or protein compounds are considered; for, though numerous anomalies appear, they are undoubtedly greatly increased when the specific gravity is high. Taking the average of the first and last half as before, it appears that in the 10,000 parts of the former there are 71.3 of protein compounds, and in the latter 84.3. But this result is only obtainable from the averages, for in individual cases the variations are exceedingly great, and the two highest specific gravities correspond to quantities of nitrogenous matters which scarcely exceed the average. The conclusion, therefore, to be drawn from the whole facts appears to be, that though a high average specific gravity undoubtedly indicates a high nutritive value, the character must be applied only with extreme caution to individual turnips.

It is unquestionable that the anomalies observed are to be attributed to the variable quantity of air contained in the cells; and if it were entirely absent, it admits of no doubt that specific gravity would be a much more precise character. It is necessary, therefore, to ascertain whether there are any methods by which the uncertainty dependent upon this peculiarity can be got over. A moment's consideration shows that the specific gravity of the juice is not subject to the same uncertainty. It is squeezed out of the cells, and of course contains no imprisoned air. It is liable to this objection, however, that its specific gravity can indicate accurately only the proportion of the nutritive matters soluble in water. On examining, however, the analysis of the different turnips, it is apparent that the greater part of the nutritive matters are contained in the juice, and that the fibre forms a comparatively small proportion of the whole. Further, there is every reason to suppose that the more soluble substances, from the greater facility with which they can be assimilated by the animals, have a higher nutritive value than those contained in the insoluble or difficult soluble fibre. The composition of the juice may therefore be assumed to

give a near approximation to the value of the whole turnip. That its specific gravity, also, gives trustworthy indications of the nutritive value is apparent from the following table, which is constructed in a manner similar to that given in a former page, except that the turnips are arranged in the order of the specific gravity of their juices:—

II.—TABLE showing the Quantity of Solid Matters and Protein Compounds in the Turnips arranged in the order of the Specific Gravity of their Juice.

Specific gravity of juice.	Dry matter in 100 parts of the juice.	Dry matter in 100 parts of the turnip.	Total nitrogen in 10,000.	Total protein compounds in 10,000.
1.020	4.71	6.00	7.00	43.90
1.023	4.20	4.46	10.22	65.0
1.025	5.63	5.44	10.00	63.0
1.025	4.90	5.48	9.80	61.5
1.029	5.49	6.71	9.91	62.0
1.030	6.26	7.55	11.00	69.3
1.030	6.32	6.71	13.10	82.5
1.031	5.91	8.46	16.50	103.5
1.032	6.30	7.31	8.60	54.0
1.032	6.07	8.85	15.20	96.0
1.035	6.83	7.43	13.90	87.2
1.035	6.64	7.42	16.40	103.0
1.036	6.84	9.26	12.10	76.0
1.037	6.72	7.68	11.00	69.3
1.037	7.48	8.99	12.30	77.0
1.041	7.31	9.46	17.70	111.2
1.042	8.27	9.13	19.66	123.0

From this table it appears that the specific gravity of the juice is the most absolute indication of the quantity of dry matters contained in it, and it gives also a tolerably exact idea of the whole of the solid matters contained in the turnip. An exception is no doubt found in the first in the table, which, though the lowest specific gravity, contains a larger quantity of total dry matters than those which follow it; but with all the others we observe a pretty close concordance between the two quantities. This is more prominently brought out when we take the average of the highest and lowest specific gravities. It then appears that the nine lowest correspond on the average to 6.35 per cent of dry matter in the turnip, and the eight highest to 8.52. Exactly the same observations are applicable to the protein compounds. The largest and smallest quantities of these constituents correspond also to the highest and lowest specific gravities of the juice, and though a similar correspondence is not in all cases observable, the average of the whole of the analyses leads to the same result. The nine lowest specific gravities correspond to 67.0 parts in the ten thousand of protein compounds, and the eight highest to 92.8. It is unnecessary for me to extend the discussion to the variations in the other individual constituents of the turnip, which are of less moment in form-

ing an opinion of its nutritive value, although they are not without interest. It does not appear that there is any relation between their proportions and the specific gravity, and for the purpose of drawing conclusions the quantities of nitrogenous matters and total solids are all that are required, the former as indicating the quantity of flesh-forming nutriment, the latter that of the respiratory elements, which can be determined with sufficient accuracy for practical purposes, by taking the difference of the two numbers.

The conclusions to be drawn from these experiments are sufficiently obvious. 1st, It appears that the specific gravity of the whole turnip is a rather uncertain guide to the determination of its nutritive value, for it is open to a source of fallacy dependent upon the quantity of air contained within the cells, which there is every reason to suppose varies in different turnips, and is no doubt the cause why all, except Swedes, are lighter than water. 2d, It appears that the specific gravity does not correspond in any way with the quantity of solid matters, but that the protein compounds are somewhat increased. It is scarcely safe, however, to conclude that this will be observed in all cases, the more especially as it is not possible to explain it in a satisfactory manner; and we find that, in individual instances, the variations from the mean are so great and uncertain in their direction, that the small superiority in the protein compounds, when the specific gravity is high, is most probably fortuitous. 3d, The specific gravity of the juice gives a very accurate estimate of the nutritive value of a turnip, for it shows that the quantity both of solid matters and of protein compounds is larger, and the relation between them is sufficiently close to make it possible to rely upon it with certainty.

In short, the general conclusion is, that the specific gravity of the juice gives a more accurate estimate of the value of the turnip than that of the whole root. It is not, however, to be supposed that the latter is devoid of value, for it appears to me that it is calculated to give very valuable information as to the keeping qualities of different turnips. It admits of no doubt, that the turnips which have the highest specific gravity are those with the smallest number of air-cells. Now, it is an established fact that the exclusion of air is a most essential point, when we wish to preserve vegetable matters unchanged, for it is its presence which promotes fermentation, putrefaction, and all those changes which cause their deterioration. If the access of the external air is prejudicial, it is not difficult to see that that which is imprisoned in the cells, and comes into immediate contact with the decomposable matters, must be doubly injurious. Hence it is that the swede, which has the highest specific gravity—that is, has the smallest quantity of air in its cells—is the best-keeping turnip, and is still serviceable in late spring when all the other varieties are nearly,

if not altogether, useless. Such being the case, it appears that the value of a turnip may be most accurately determined by ascertaining both the specific gravity of the whole root and of its juice; the former chiefly as a means of testing its keeping, the latter its nutritive qualities. The greatest triumph of agricultural art would be to obtain a turnip of which the cells were entirely devoid of air, and then the specific gravity of the juice would become an unnecessary character, that of the entire root being in that case sufficient for all purposes. Let us hope that this may be the eventual result of the experiments which the Marquess of Tweeddale has now in progress.

As regards the general applicability of specific gravity to determining the value of different crops, the details I have given, both of Reiset's experiments and my own, leave no doubt, but it is obvious that the question is complicated by various circumstances,—in the grains, by the ignorant prejudices of the public in favour of a bread which shall please the eye, and in the case of roots, by the difficulties introduced by the presence of air in their cells. Time will no doubt open people's eyes to the absurdity of sacrificing the substance for the shadow, and further experiment enable us to fix some mode in which specific gravity may be made as useful a character in agriculture as it has long been in the other arts.

II. ON THE COMPOSITION OF THE CABBAGE USED FOR FEEDING PURPOSES.

The cabbage grown for feeding attains a very large size before its heart is formed, and after that time increases comparatively little in weight, the outer leaves decaying to a greater or less extent. But although this is the case, it is not customary to make use of it until the heart is formed, when it is considered to be ripe, and to have obtained its maximum of feeding value. Should this opinion be correct, then nothing can be objected to the practice; but should it prove that the nutritive value is as high during the first as it is during the latter part of its growth, then the cabbage might be advantageously used much earlier in the season than has hitherto been usual. I owe to Mr Telfer of Cunning Park the opportunity of submitting this point to the test of experiment, by making analyses of cabbage before and after the heart was formed.

The analyses were made in the usual way, but great care was taken that the quantity used for this purpose should represent with fairness the average composition of the whole cabbage.

The young cabbage (that is, the specimen taken before the formation of the heart) gave—

Protein compounds,	2.11
Fibre, gum, sugar, &c.,	4.51
Ash,	1.60
Total solids,	8.22
Water,	91.78
	100.00
Nitrogen,	0.34

The ash contained—

Potash,	29.75
Chloride of potassium,	2.94
Chloride of sodium,	9.33
Lime,	18.53
Magnesia,	3.43
Oxide of iron,	.46
Sulphuric acid,	11.78
Phosphoric acid,	6.75
Carbonic acid,	15.48
Silica,	.48
Sand,	1.16
Charcoal,	.10
	100.19

This analysis, when re-calculated after deduction of the sand and charcoal, gives—

Potash,	30.07
Chloride of potassium,	2.97
Chloride of sodium,	9.43
Lime,	18.73
Magnesia,	3.47
Oxide of iron,	0.46
Sulphuric acid,	11.91
Phosphoric acid,	6.82
Carbonic acid,	15.65
Silica,	0.49
	100.00

In analysing the full-grown cabbage, the outer green leaves were separated from the heart, and each subjected to a separate analysis, and the results were—

	Outer leaves.	Heart.
Protein compounds,	1.63	0.94
Fibre, gum, sugar, &c.,	5.06	4.08
Ash,	2.23	0.56
Total solids,	8.92	5.58
Water,	91.08	94.48
	100.00	100.00
Nitrogen,	0.26	0.15

The composition of the ash was—

Potash,	14.18	37.34
Soda,	...	1.01
Chloride of potassium,	8.27	...
Chloride of sodium,	8.69	5.53
Lime,	23.42	11.22
Magnesia,	3.06	2.81
Oxide of iron,	1.79	0.41
Sulphuric acid,	15.71	13.49
Phosphoric acid,	2.80	5.27
Carbonic acid,	14.33	18.52
Silica,	2.63	0.80
Sand,	2.98	3.23
Charcoal,	1.61	0.18
	99.47	99.81

The same calculated without sand and charcoal—

Potash,	14.96	38.74
Soda,	"	1.05
Chloride of potassium,	8.71	"
Chloride of sodium,	9.16	5.73
Lime,	24.68	11.64
Magnesia,	3.22	2.91
Oxide of iron,	1.89	0.43
Sulphuric acid,	16.56	13.99
Phosphoric acid,	2.95	5.47
Carbonic acid,	15.10	19.21
Silica,	2.77	0.83
	100.00	100.00

A comparison of these analyses displays several points of considerable interest. It appears that the quantity of solid matters in the young cabbage, and in the outer leaves of the full-grown plant, materially exceeds that in the heart of the latter, and this is consistent with all we know of the chemical constitution of plants. It has been established that blanched or etiolated plants contain more water, and are poorer in nutritive matters, than those which have been exposed to the sun's rays, and have grown under normal conditions. Now the heart of a cabbage is protected from the light by the outer leaves, and is in the condition of a plant which has been etiolated by exclusion of light, and with this its chemical composition also agrees. The proportion of protein or albuminous compounds is also much less in the heart of the cabbage than in the external leaves or the young plant. Indeed, it is obvious that the latter has a materially higher nutritive value, as indicated by the per-centage of nitrogen, than either the external part, or the heart of the mature cabbage; and it is clear that the young cabbage may be advantageously employed for feeding before it has formed its heart. In fact, from its superiority at that period, it may be used even when its weight falls considerably short of that which it may afterwards attain. In order to illustrate this point, let us suppose that the full-grown cabbage consists in equal proportions of heart and external leaves. Then it will contain on the average 1.28 per cent of protein compounds; and if this be taken as the measure of its nutritive value, as has been done by Boussingault and other observers, 100 tons of the young cabbage will be equal in the production of flesh to 170 tons of the full-grown plant.

The large proportion of ash contained in the mature leaves is also remarkable. In the old cabbage, it is exactly four times as great as it is in the heart, and a similar, though not quite so great an excess, is also observed in the young cabbage. The variations in the composition of the ash are also extremely remarkable. We see that the quantity of potash in the heart greatly exceeds that in the other two ashes. But the difference is most conspicuous

between the outer and inner leaves of the same cabbage, the latter containing just twice as much potash (including, of course, that existing in the chloride of potassium) as the former. The deficiency of potash in the outer leaves appears to be made up by lime, which is present in very large quantity. A careful inspection of the analyses will point out other interesting peculiarities which it is unnecessary to specify.

In estimating the value of the field cabbage in relation to other cattle food, it may be most safely compared with the turnip. The full-grown cabbage, taking together both leaves and heart, is almost exactly equal in value to the same quantity of turnip, while the young cabbage is equal to nearly double its weight of that root. It must not be supposed, however, that this is to be assumed as invariable; so far from this being the case, it is quite possible that the average difference may not be so large as it has proved in the present instance: and while I should be sorry to have it supposed that the single analysis now given should be taken to indicate the invariable relation in value of the young and old cabbage, they merit attention as pointing to a fact, which, if confirmed by further experiment, may prove of considerable practical importance.

III. COMPOSITION OF SALTPETRE REFUSE.

The refuse salt obtained during the purification of crude saltpetre for the manufacture of gunpowder, is usually sold as a manure. It varies considerably in composition, according to the purity of the original salt, and is not unfrequently of considerable value. A sample recently analysed in the Laboratory contained—

Water,	5.71
Sulphate of potash,	7.92
Nitrate of potash,	51.46
Chloride of potassium,	11.69
Chloride of sodium,	18.04
Sand,	3.97
	100.00

A substance, containing half its weight of pure nitre, along with considerable quantities of other salts of potash, must, of necessity, prove a valuable manure, and it is probable that, as a top-dressing for clover, hay, and rye-grass, it would prove extremely valuable. We know that nitric acid affords nitrogen as a very favourable form for the grasses, while we have every reason to suppose that potash is a very important element in the clover plant. Indeed, it appears extremely probable that the clover sickness is due to the absence of a sufficiently large quantity of potash for the requirements of the plant; and its use in a form which supplies also abundance of nitrogen, in a condition peculiarly suited to the rye-grass, seems likely to afford favourable results.

In purchasing such a refuse, however, the farmer would do well to be cautious, as it must vary greatly at different times, even when coming from the same manufacturer. Crude nitre frequently contains very large quantities of common salt, and in these cases the refuse containing the whole of that substance, and probably little else besides, may prove of very small value.

IV.—COMPOSITION OF TWO MANURES PRODUCED BY THE PRECIPITATION OF SEWAGE WATER.

Numerous attempts have been made to bring the valuable constituents of sewage water into an available condition, and the methods proposed for effecting this object have been extremely varied. By far the greater number of patents taken for the purpose, have consisted of various plans for precipitating the valuable constituents; and though chemists have frequently pointed out—as has been very distinctly done both by Professor Way and myself—that ammonia, the most valuable constituent of a manure, cannot be precipitated by any process whatever, except such as are altogether precluded by their expense, still, new patents are constantly being taken for doing what is impossible.

The two analyses which follow, may serve as illustrations of what may be effected. They were produced by experiments on a scale sufficiently large to test the value of the process, and the results are described as having been most perfect, and in every way successful. The exact mode in which the precipitation was effected has not been described to me; but this is of little importance, as the insignificant value of the product is the point to which I wish to direct attention.

	I.	II.
Water,	18.04	4.03
Organic matter,	19.71	30.13
Phosphoric acid,	2.03	0.60
Peroxide of iron and alumina,	6.93	7.10
Sulphate of lime,	27.05	3.14
Carbonate of lime,	6.43	3.70
Alkaline salts,	3.00	"
Sand,	16.81	51.13
	100.00	99.83
Ammonia,	1.13	0.64

A very trivial examination suffices to show that these substances are of trifling value. The first, which is the best of the two, and contains 2 per cent of phosphoric acid and 1 of ammonia, when calculated according to the method used for determining the price of a guano, proves to be worth only about 16s. per ton, and the second does not exceed 7s.; yet these and similar substances are gravely declared to be equal in value to guano, and large companies and extensive works have been proposed for manufacturing

them. The absurdity of such proposals is sufficiently obvious, but it may still be urged that the quantity of valuable matters which might thus be annually saved from the sewage of a large town, would be very considerable; and this view is no doubt correct as an abstract question, although in practice it could not be economically carried out. Granting that the precipitation could be effected even at a nominal cost, it is indubitable that only a small proportion of the constituents of the sewage could be regained, and, after precipitation, a large expenditure would be required to bring the precipitate into a marketable condition, and the cost of transport would be so large, in comparison with its value, that it could not be economically employed, except in the immediate neighbourhood of the place of manufacture. This question I have discussed on theoretical grounds in a previous number of the Transactions, and I adduce the experiments now given as a confirmation of the opinions then expressed. In the particular instance before us, the expense of manufacture would undoubtedly greatly exceed the value of the manure, and as the whole process is represented as much cheaper and more effectual than any yet proposed, these analyses may be taken as a pretty conclusive proof of the futility of all processes for the precipitation of sewage water.

I have seen no reason to alter the opinion expressed in a previous number, that if sewage is to be employed at all, it must be used *in toto* as liquid manure. I do not mean to assert that this can be done with profit, that being a question which engineers, and not chemists, must decide; for it is obvious that everything must depend on the cost of the works necessary for carrying it out.

AGRICULTURAL STATISTICS OF SCOTLAND, 1855.

HIGHLAND AND AGRICULTURAL SOCIETY,
Edinburgh, 11*th December* 1855.

SIR,—In fulfilment of the duty intrusted by the Lords of the Committee of Privy Council for Trade to the Highland and Agricultural Society, I have the honour of forwarding to my Lords the Statistical Returns of the Agriculture of Scotland for 1855.

The five tables appended are framed on the same principle as those published last year. The first four are applicable to counties, and the fifth refers to districts or subdivisions of counties.

No. 1 contains the number of occupants, and the acreage in tillage, of agricultural tenements valued at rentals of £10 or £20, according to the counties in which they are situated.

No. 2. The amount of stock possessed by these occupants.

No. 3. The gross estimated produce of the principal cereal and root crops.

No. 4. The estimated average produce per acre of the same crops.

No. 5. The estimated averages per acre which have been reported for each district, into which counties are subdivided.

The list of parishes composing the different districts is attached, and I was desirous of adding to it the substance of reports by Enumerators, respecting the weight per bushel, and the general quality of the crops in their respective districts. I find, however, that further correspondence is necessary to complete my information; and, being unwilling to defer the publication of the tables, I shall reserve that part of the report for a supplementary letter. I may, in the mean time, state that the weight of grain is generally deficient.

It will be observed that Tables 1, 3, 4, and 5, contain double columns, indicating the acreage, estimated produce, and averages per acre for 1854 as well as for 1855. Table No. 2 gives a duplicate statement only of the total amount of stock—the schedule for stock having been so much altered since 1854, that the columns cannot be well contrasted. Indeed, before instituting a comparison between the returns for the two years, it should be borne in mind that the mode of taking them has in several respects been considerably changed, and that the results cannot, therefore, entirely correspond. As some of the differences may be liable to an incorrect construction, I shall endeavour to notice and explain the most material of them.

I. OCCUPANTS.

The returns of 1854 did not indicate the number of occupants, but in the report then submitted to my Lords I stated that "in

round numbers about 50,000 schedules were issued, and of these about 100 are unaccounted for." I have this year endeavoured to arrive at more exact results regarding this part of the inquiry, and to restrict the list of occupants to those whose status is purely agricultural, by striking off the names of householders, feuars, owners of villas, &c. The number has further been reduced by scheduling together any number of farms lying in the same parish, and leased by the same individual, thus regulating the roll by the number of occupants and not of tenements. Woods form no part of the present inquiry; there is, consequently, a further diminution corresponding to the number of persons whose returns were last year confined to woods. Effect having been given to these modifications, the list contains 4340 occupants rented at and above £20 in the counties of Argyle, Caithness, Inverness, Orkney and Zetland, Ross and Cromarty, and Sutherland, and in the Island of Arran, and 39,127 rented at £10 and upwards in the remaining counties; and I have great pleasure in reporting to my Lords that the returns of acreage and stock may be regarded as complete for the whole number of 43,467, with the exception of one farmer in Argyleshire, and four persons occupying small portions of land in Aberdeenshire. The former has twice forwarded his schedule, but it has miscarried, and his return could easily be obtained were I to incur the delay attending the correspondence, at this season, with one in a remote insular locality. The four cases of omission in Aberdeenshire do not together involve a difference of many acres, and being unimportant, it is not necessary to defer the report on their account.*

I do not mean to affirm that information was always voluntarily tendered, or that there have not been instances where it was refused; an entire absence of opposition is not to be looked for in connection with such a measure, but its extent has been singularly and satisfactorily minute. There were no exact means last year for determining this point, or for ascertaining how many returns had been made by Enumerators in consequence of refusals. I have now, however, obtained reports as to this from every district, which enable me to state that in thirteen counties, though there may have been instances of neglect and oversight, there was not one of absolute refusal and opposition; while in the other nineteen counties there were about sixty cases of that character. I cannot close this section of the report without repeating what I was last year enabled to state, respecting the manner in which the Scotch farmers, as a body, have recognised the importance and utility of statistical information, by readily and faithfully affording the returns required; and it is due to them to observe that the slender minority in opposition does not entirely consist of their class: I regret to say that it comprises the names of landlords whose in-

* These returns have since been obtained, and are included in the tables.

fluence might have been looked for in an opposite direction, but whose example has been fortunately disregarded by their tenants.

II. Acreage.

The gross returns of acreage published last year cannot be set against those of 1855, inasmuch as, for reasons already made public, six of the columns employed in 1854 were deleted from the schedule of 1855. The corresponding columns for the two years, therefore, are only contrasted, but in one important point even these do not afford data for a fair comparison as regards the gross results. The schedule for 1854 contained a column for "*grass under rotation,*" and another for "*permanent pasture;*" it is difficult sometimes to draw a line between these, and, consequently, a considerable extent which had been, and again may be, under the plough, was formerly scheduled as "permanent pasture." This year the returns of acreage are limited to tillage, the column for "permanent pasture" having been omitted, and instructions given to schedule as "*grass and hay under rotation*" all land "which, in the ordinary rotation or course of cropping of the farm, will sooner or later be again broken up." The result has been to swell the column for grass under rotation by the transference to it of much which last year appeared as permanent pasture; the difference thus created amounts to 82,253¾ acres, and will be found to tell more particularly in the dairy districts.

There are a few minor discrepancies traced to errors of a character which cannot always be guarded against, and which occurred last year. One of these was caused by a double calculation in my own office, and slightly affected the breadth of oats in Banffshire. In Selkirkshire, also, the acreage was, to a trifling extent, too high in 1854, owing to a double return by a tenant. Caithness shows an apparent decrease of acreage and stock, which is accounted for by the excision of a considerable number of occupants rented at from £10 to £20, who before were on the list. Inverness exhibits a deficit, and Nairn an excess, on the returns of last year, produced by the transference of the parish of Moy from the one county to the other, to facilitate district arrangements. In other respects, it is conceived that the returns for the two years generally correspond, if allowance be made for such fluctuations in cropping as are fairly attributable to, and must ever occur in consequence of, prices, weather, and other accidental but inevitable influences. The green crops, particularly turnips, show a large increase, indicating, probably, a greater breadth in preparation for grain; but the extent under cereals is nearly the same, though the distribution of the different crops varies. Wheat has increased by 23,084¾ acres. Barley has decreased by 21,424¾. There is a trifling difference in favour of oats, and against the other crops, but the gross returns for the two years, as regards the acreage under wheat, barley, oats, rye, bere, beans, come within 250¼ acres of each

other. In 1854 there were 1,374,515¼, and in 1855, 1,374,765½ acres.

I have to express my regret that, owing partly to circumstances personal to myself which have already been explained to my Lords, and partly to a desire that the returns should be as complete as possible, I did not succeed in publishing a statement of acreage separately and at an earlier period; but, from the increased facilities now experienced in working the measure, I foresee no difficulty hereafter in giving effect to the wish which has been expressed by my Lords on this point; though, to prevent disappointment, I would take the liberty of recommending that the schedules should be issued on the 1st of June instead of the 1st of July.

In accordance with my instructions, the general inquiry into the acreage and stock in the hands of tenants below the £10 and the £20 rental, has not been repeated. Though the number of such occupants is great, the statistics of their holding are unimportant, and not being subject to sudden fluctuations, it was conceived that the results obtained last year may with safety be readopted.

III. Stock.

The gross returns of stock at first sight exhibit a startling excess over those of last year, but the difference is almost exclusively confined to horses and sheep, and is easily accounted for. In 1854, there was but one column for horses, under which in general only the animals employed on the farm were returned; now, there are three columns embracing horses of all ages and descriptions, and there is consequently a larger return. The great difference, however, is in the number of sheep. In 1854 there was no column for lambs, which, by the instructions appended to the schedule, should have been returned with ewes and wethers. Many overlooked this direction, and, seeing no mention of lambs in the schedule, omitted them; but, as there is now a special column, the return has been general, reducing to a certain extent the number of ewes and wethers, but adding to the gross amount of sheep stock. The increase on the total stock this year is 937,911—while that on horses and sheep alone is 928,299.

IV. Estimates of Produce.

The system adopted in 1854 for obtaining estimates of the crops has been continued. In discharge of this important duty, each Enumerator was assisted by a committee, composed of experienced farmers from the different parishes of his district, whose attention had been directed to the state of the crops both before and after harvest, and whose reports are restricted to the localities with which they are immediately connected. With the view of having the estimates taken about the same date and under similar circumstances, and of providing time sufficient for testing the character of the crops in the barn, Enumerators were this year instructed to call

their committees together not earlier than the 15th nor later than the 30th November, and to draw up their reports within that period.

Another regulation was introduced in order to give greater uniformity to the estimates, as well as to embrace the whole produce of the farm. Having ascertained that, in 1854, the light or inferior grain, which is usually consumed on the farm, had in many cases been excluded from the estimates, directions were given to Enumerators to include it, by reducing it to its equivalent in good grain, according to marketable value, and by adding it to the average produce per acre. To a certain extent this interferes with a comparison between the averages of the two years. I am unable to determine the exact increase this creates, or to state the number of districts in which it has had effect, but it may be assumed that the light grain was generally omitted last year, and that a certain deduction must therefore, on a comparison, be allowed from the averages of 1855.

As the addition of fractional parts of pecks to the averages may be looked on as too minute an attempt at accuracy for an estimate, I should explain that these fractions were not reported by Enumerators, but brought out in converting to Imperial measurement averages made according to Scotch.

Having endeavoured to notice the differences observable between the returns of the two years, I may be permitted to advert to the advantages consequent on the changes by which these differences have been caused.

The list of occupants has been purged and corrected, and now represents the holders of proper agricultural tenements, rented at and above £10 or £20, according to the counties in which they are situated. The returns of acreage, though less comprehensive than those of 1854, indicate the extent of land under a rotation of tillage, with greater accuracy than could be claimed for the returns made formerly in the columns for permanent pasture, sheep-walks, wood, &c. The deletion of these columns may have been objected to as tending to circumscribe the scope of the inquiry, but, so long as the Ordnance Survey of Scotland is incomplete, they cannot be filled, in many districts, with even an approximation to accuracy; and, notwithstanding the care with which their incomplete character was explained, they were, and would continue to be, too often accepted as correct, and used as data for erroneous conclusions. The alterations in the columns for horses and sheep have produced fuller returns of stock. And, finally, a greater degree of uniformity has been given to the estimates of produce.

I have again the pleasure of being called upon to report the able, judicious, and satisfactory manner in which the district Enumerators have discharged their important duties, whether as regards the completion of the returns, or the careful preparation of the estimates of produce; and it is right that the attention of my Lords should be particularly directed to the services freely and gratuitously

rendered by the members of committee. These gentlemen constitute a selected body of above 1000 of the tenant-farmers of Scotland, and their assistance is not only of the greatest value in obtaining correct estimates of produce, but their co-operation stamps the statistical inquiry with an amount of agricultural approbation, and lends to it a weight of agricultural influence, which have materially conduced to its success.

I have the honour to be, &c.

(Signed) JN. HALL MAXWELL.

JAMES BOOTH, Esq.
Principal Secretary of the Board of Trade.

The following acknowledgment has been received from the Principal Secretary of the Board of Trade:—

OFFICE OF COMMITTEE OF PRIVY COUNCIL FOR TRADE,
WHITEHALL, *December* 18, 1855.

SIR,—I am directed by the Lords of the Committee of Privy Council for Trade to acknowledge the receipt of your letter of the 11th instant, transmitting the Statistical Returns of the Agriculture of Scotland for the year 1855, which have been prepared under the authority of the Highland and Agricultural Society of Scotland, in pursuance of their Lordships' request.

It is the pleasing duty of my Lords once more to convey to the Directors of the Society their best thanks for their most valuable services, in connection with this important National Enquiry, the practicability of conducting which, successfully, no longer remains a matter of question, but has been satisfactorily established by the complete success of two consecutive experiments. At the same time, they cannot withhold the expression of the high sense entertained by them of the indefatigable and able services rendered by yourself, as the Secretary to the Society, which have rendered it possible for their Lordships to be in possession of so much valuable information at this early date.

My Lords also appreciate most highly the assistance rendered with so much diligence and zeal by the district Enumerators, and by the intelligent body of Farmers composing the Committees, whose services are so appropriately described by you; and they request that the Highland Society will make themselves the channel of conveying to those different gentlemen the expression of my Lords' thanks accordingly.

Their Lordships will give directions for the Report in question, and its various enclosures, being laid before Parliament as soon as possible.

I am,
SIR,
Your obedient Servant,
(Signed) JAMES BOOTH.

J. HALL MAXWELL, Esq.

TABLE No. I.—ACREAGE UNDER TILLAGE.

COUNTIES.	Occupants.	Total Acreage. 1855.	Total Acreage. 1854.	Wheat. 1855.	Wheat. 1854.	Barley. 1855.	Barley. 1854.	Oats. 1855.	Oats. 1854.	Rye. 1855.	Rye. 1854.	Bere. 1855.	Bere. 1854.
1. Aberdeen	7,326	479,058¾	475,427½	5,409¾	3,222½	7,109	8,138¼	170,087¼	171,408	225¼	313	4,741¼	5,322¾
2. *Argyll	1,620	80,953¼	78,790½	427¾	266	1,240¼	1,658¼	22,892½	24,252½	374¾	551¾	1,814¾	1,888¼
3. Ayr	3,399	258,154¾	247,884	12,847½	11,187½	682¾	802½	61,648¼	63,445¼	361½	356¾	288¼	217¼
4. Banff	1,719	111,214½	115,425¼	1,173¼	988	3,649¼	4,190	41,404¾	42,932½	38¾	34¼	730¼	864¾
5. Berwick	766	146,944	145,547¼	9,982¾	10,003½	15,119½	16,576¾	31,793¼	31,892¾	54½	24¾	57	33½
6. { Bute	138	12,064¼	11,783¼	832¾	571¾	154¾	245½	2,680¾	2,773	5½	17¼	—	—
{ *Arran	152	6,086	5,900¼	184¾	138	17¾	44	1,661¼	1,730	30¼	54	133¾	159¼
7. *Caithness	504	47,854½	53,497¼	168	129	243½	265¼	18,288¼	21,076½	6¼	5¾	1,683½	2,710¼
8. Clackmannan	225	19,079	16,966½	2,225½	1,864¼	1,780¾	1,896	3,971¾	3,915¼	½	1¼	6¼	—
9. Dumbarton	630	42,256¼	37,840¼	2,099	1,628¾	957	1,418	9,904¼	9,169	28	59¾	27¼	14½
10. Dumfries	1,994	174,363½	174,254	3,244½	3,303¾	2,578	3,308¼	50,499¼	49,515	118¼	154¼	34	23½
11. Edinburgh	898	102,604½	99,275	9,113¼	8,128	10,297½	11,212¾	23,488¾	22,852	¼	—	162¾	50¼
12. Elgin	1,159	79,853¼	77,401½	7,298¾	7,413½	8,508	8,916¾	17,974¼	16,887	471¾	409½	494½	512¾
13. Fife	1,973	218,534¾	212,806	26,952¾	24,252¼	25,934	27,937¾	44,137¾	43,591¼	618½	417¼	34½	16¼
14. Forfar	2,162	215,270½	213,878½	16,232½	12,795¼	23,135¾	25,222½	50,896	50,995¾	134¼	111½	337	236
15. Haddington	462	101,528¾	98,977½	17,472½	16,881¼	10,856	12,086¼	16,692¾	15,668½	32½	50¾	44	40½
16. *Inverness	749	42,030¼	44,242¾	1,539½	1,684	2,220¾	2,660	13,704¾	13,674½	125	141	1,034¼	1,014
17. Kincardine	1,407	101,458¼	97,161	2,767½	2,327	7,598¼	7,815¾	29,785¾	29,451	173½	62	678¼	664½
18. Kinross	311	33,132½	32,869½	909½	448¼	2,867¼	3,136½	8,030½	8,234¼	9¼	15	1	9½
19. Kirkcudbright	1,414	124,821¾	124,128	1,715¼	1,895¼	1,382½	1,848¼	33,858¼	32,147	40	22½	19	37½
20. Lanark	3,133	206,405¼	190,160¼	7,582	6,440¾	2,037¾	2,290¼	54,738	56,116¾	68	164	369¼	252½
21. Linlithgow	464	52,788¾	50,424¾	3,792	2,850	4,057¼	4,653½	12,339	12,883¾	3¼	35½	8	5¼
22. Nairn	428	29,553	27,294½	1,714½	1,867½	3,043½	3,221	7,752¾	6,649¾	255	119	87	31¾
23. { *Orkney	262	23,989¾	19,473	15	7½	82¾	145	7,962¾	6,496	11½	70½	2,931¼	2,849½
{ *Zetland	39	1,206¼	771¾	—	—	18½	4¾	380¼	258½	—	—	70	72¾
24. Peebles	314	36,436¼	34,989¾	104¾	53¾	2,027	2,122¼	9,910¼	9,572	1	12½	27¼	26½
25. Perth	3,737	260,829¼	255,567½	22,201¾	17,893	19,318¼	22,710½	63,051¼	62,712¼	113	89¾	773¾	502¾
26. Renfrew	1,249	75,213	66,424¼	4,495¼	3,973¼	428¼	421½	16,392	16,357	12	37¼	84½	55¾
27. *Ross & Cromarty	873	70,513½	69,919¼	8,962¼	7,527¼	6,182¾	7,387¾	16,132¼	16,645¼	149½	161¾	220¾	163
28. Roxburgh	1,027	134,781	126,249½	7,133¼	6,903¼	12,462¾	13,407¾	29,198½	28,381	38¼	88½	10½	6
29. Selkirk	171	11,134¼	11,972½	116½	51	677	933	2,963½	3,456¼	—	—	7	—
30. Stirling	1,483	91,400	85,532¼	4,985½	3,987¼	6,773	7,337	22,378¾	22,028¼	25½	101	18	47½
31. *Sutherland	141	10,674¼	10,597½	258	299½	1,051¾	1,349	2,461	2,530¾	16½	11¾	97¼	55¾
32. Wigtown	1,140	127,880¾	118,053	7,343	7,235	1,589¼	2,144½	34,602¼	33,295½	150	115¼	237½	233¾
	43,467	3,530,068½	3,431,485¼	191,300¾	168,216	186,082¼	207,507	933,662½	932,994	3,692	3,809	17,263½	18,118

COUNTIES.	Beans. 1855.	Beans. 1854.	Pease. 1855.	Pease. 1854.	Vetches. 1855.	Vetches. 1854.	Turnips. 1855.	Turnips. 1854.	Potatoes. 1855.	Potatoes. 1854.	Mangold. 1855.	Mangold. 1854.	Carrots. 1855.	Carrots. 1854.
1. Aberdeen	324¾	331¼	289¼	262¾	1,021	826¾	79,612¾	78,042½	7,498	7,210¾	16½	17	70½	41¼
2. *Argyll	636½	531½	94	104	150½	116¾	6,346¼	5,623	5,178¾	6,179	33¼	28¼	17¼	23¼
3. Ayr	3,485¼	3,501¾	34¾	28¼	420	373¼	16,480¾	15,158½	8,166½	8,386½	828½	717¼	307¼	322
4. Banff	167¾	131	80¾	97¾	357½	265¼	17,412½	17,216¼	2,159¼	2,370	9¾	6¾	5	3½
5. Berwick	1,613½	1,685¼	670¾	668¾	880¼	837½	26,980¾	26,388¾	2,104	1,892½	57½	52¼	14½	15¾
6. { Bute	11	4½	¼	—	25	19½	1,188	1,101¼	625½	673	4¾	5½	½	—
{ *Arran	118½	139¾	40½	28¼	3¼	½	421¼	408½	342¼	405¼	10¾	22	4	4½
7. *Caithness	—	—	—	32¾	252½	236	7,326	7,752¼	1,442¼	1,846¾	—	28½	¼	—
8. Clackmannan	1,532½	1,478¼	—	—	143½	114	1,832¾	1,692	382¼	310	18¼	6¼	8	2¼
9. Dumbarton	715	621½	14	8¾	164¾	155¼	2,567	2,419½	2,378	2,368½	37¾	35¼	6¼	2¾
10. Dumfries	512¾	571¼	26	24	184¼	157¾	20,684½	19,788¾	6,300½	7,247¼	40½	40½	45¼	48½
11. Edinburgh	1,426¾	1,551	144¼	185¼	1,135¼	1,080¼	13,862¼	14,288½	6,749¾	5,518½	96	77	38	62
12. Elgin	84¾	56¼	224¾	286½	240	231	11,067¾	11,140¼	3,717	4,129¼	7¾	11	2½	5¾
13. Fife	3,441	3,894	621	718¼	1,491¼	1,397½	28,991¼	27,961¾	17,355	14,486¾	103½	78	33¼	43
14. Forfar	516½	600¾	271	138½	938¼	772¼	32,518¼	32,198	14,258½	12,529¾	9¼	12	26½	27¼
15. Haddington	3,930¾	3,620½	170¼	335¾	1,058¾	903½	16,063½	15,342¼	6,451½	6,442¼	114	89	122¾	103
16. *Inverness	67¼	85¾	162½	234½	186¾	141¾	5,286¾	5,135	2,916½	3,524¼	16¼	10	2	3¼
17. Kincardine	460¾	474¾	50	77¼	228¼	182½	16,690	16,087¾	2,937	2,645½	6	5¼	28	21
18. Kinross	134	139¼	24	11	230	199¾	4,270½	4,141¾	1,053¾	857¾	1¼	—	2¾	¾
19. Kirkcudbright	395	467¾	4¼	8¼	63	73¾	14,535	13,502¼	2,965¾	3,349	58¼	54¼	31¾	45¼
20. Lanark	3,844	3,735¾	362	430	1,670½	1,581	11,341½	10,885¾	8,202¼	8,016¾	80	58	39¾	23½
21. Linlithgow	1,657¾	1,783¾	52¾	22¾	416½	402½	4,983¾	4,856¾	1,925¼	1,627¼	28¾	33¾	10¾	6½
22. Nairn	16½	25½	100¾	105½	70½	62½	4,467	4,048½	1,542	1,701½	5¾	4½	—	½
23. { *Orkney	5	8¾	7½	5½	34½	45½	3,016¾	2,444¼	1,301	1,079¾	1¾	—	4	3¼
{ *Zetland	—	—	—	—	¼	—	111¾	100	75¼	66¼	—	—	¾	½
24. Peebles	19¼	3	182¾	140½	227	199¼	5,265¾	5,303½	956	842¾	4½	1	1½	1½
25. Perth	3,603¾	3,788¼	573¾	760¼	919	852	31,351½	30,237½	18,171½	15,987½	10¼	25¼	17¼	31¼
26. Renfrew	1,585¼	1,438½	10¾	26½	192¾	139¼	3,334	2,995¼	5,534½	5,500¾	120½	67½	20¼	23½
27. *Ross & Cromarty	362½	271¼	515¼	561	840	878¼	11,387¼	10,467	4,501½	5,393¾	14¾	23	1¼	¾
28. Roxburgh	762¾	962	588¾	709¾	574¼	468¾	24,080¾	23,000¼	1,760½	1,729¾	19¼	28½	5	6
29. Selkirk	½	18	32	20¾	49	23¼	1,940	2,022¼	196¼	173¼	—	—	—	½
30. Stirling	4,776¾	4,545¼	11¼	30	616	469¾	5,963½	5,432	3,607	3,321¼	14½	10½	9¾	7¼
31. *Sutherland	¾	—	13½	17¼	71	64½	1,833¾	1,852¾	371¼	434	—	—	3¾	1½
32. Wigtown	1,098¾	1,171½	82¾	14	183½	171¼	15,289½	13,891¼	3,843½	4,785¼	520¾	392¾	310¾	336½
	37,308½	37,702	5,456	6,169¼	15,038¾	13,442½	449,404½	433,915¾	146,969¾	143,032¼	2,299½	1,946¾	1,191	1,218

COUNTIES.	Cabbage. 1855.	Cabbage. 1854.	Flax. 1855.	Flax. 1854.	Turnip Seed. 1855.	Turnip Seed. 1854.	Any other Crop.† 1855.	Any other Crop.† 1854.	Bare-fallow. 1855.	Bare-fallow. 1854.	Grass and Hay under Rotation. 1855.	Grass and Hay under Rotation. 1854.
1. Aberdeen	98¾	85¾	510	322¼	234	227¾	121	—	1,024	1,067½	200,665¾	198,587½
2. *Argyll	27½	23¼	14½	26½	38¾	39½	19½	—	1,343	1,327½	40,303½	36,151
3. Ayr	263¾	460¼	69	404¾	46½	62	63½	—	944¼	988¼	151,216½	141,472
4. Banff	14¾	14¾	58½	46½	92½	49¾	11½	—	426½	450¼	43,422	45,764
5. Berwick	11½	6¼	2	10	171½	88½	153½	—	1,574½	1,676½	55,702¾	53,694
6. { Bute	5	2½	—	—	4	—	—	—	55½	15¾	6,471	6,353½
{ *Arran	4¾	7½	—	12½	5½	1¾	—	—	105¼	156	3,002¼	2,588½
7. *Caithness	9¼	9½	31	6¼	14¾	24¾	1½	—	310¾	330¼	18,076¾	19,043½
8. Clackmannan	4	½	¼	59	½	1¾	—	—	334	462½	6,838¼	5,163¼
9. Dumbarton	35¼	31¾	432½	725½	16	8	7½	—	330¼	247¾	22,536½	18,926¼
10. Dumfries	24¼	58	¼	16½	70¾	50¾	353	—	655	897	88,992½	80,034½
11. Edinburgh	75	89¼	¾	16	187	155	81¼	—	441¾	635¾	35,304	33,373½
12. Elgin	24¼	19¼	1	2	53	11¾	12	—	251½	207	28,510¾	27,162
13. Fife	9¾	7½	428¼	1,648¾	56¼	58¾	58½	—	2,451½	3,547¼	65,817	62,749¾
14. Forfar	15¼	24	5¾	136	46¾	10¼	39½	—	376½	623½	75,513	77,349¼
15. Haddington	25	32¾	—	2½	298¾	202	51½	—	1,257	1,684½	26,887½	25,492¼
16. *Inverness	25½	35½	3	2	4	11½	2¼	—	506¾	572½	14,226½	15,313¼
17. Kincardine	9	8¼	76	37	44	20	18	—	323½	310¾	39,584½	36,961¾
18. Kinross	7¼	2¾	28	134½	16½	15½	¼	—	113	372¾	15,433¾	15,150¼
19. Kirkcudbright	6	4¼	¾	2¾	37¾	29½	15½	—	294	361¾	69,399¾	70,278¾
20. Lanark	275	239½	746¼	1,275¾	11¾	10	44¼	—	1,515½	1,519¾	113,476¾	97,120¼
21. Linlithgow	10¼	10¾	169¼	187¾	70¼	57	—	—	520¾	670	22,743¼	20,358
22. Nairn	3¾	6¾	—	¼	8	13¾	—	—	105¼	143¾	10,320¾	9,292½
23. { *Orkney	34¼	30	¼	¾	46	23	6	—	232	314½	8,297½	5,954½
{ *Zetland	6¾	5¼	—	—	—	¼	—	—	7	30¾	535¾	232¾
24. Peebles	1	4	—	—	5¾	1½	3	—	83¾	111¾	17,615¾	16,594
25. Perth	33¾	30¾	65½	136¾	191½	108¼	7¾	—	2,359½	2,539½	98,057¼	97,153
26. Renfrew	40½	41	43¾	74¾	11½	10½	38¼	—	302½	324¼	42,563½	34,937¾
27. *Ross & Cromarty	4	9¼	½	2¼	37½	8½	6	—	704	777¾	20,491½	19,641¼
28. Roxburgh	13¼	8½	—	1	81	59¾	90½	—	741½	863½	57,220½	48,675¼
29. Selkirk	¼	¼	1	—	½	1	—	—	102¾	139½	5,048	5,127½
30. Stirling	35¾	37¼	770½	1,372¾	38¼	20¼	—	—	1,720½	1,961¼	39,655½	34,823¾
31. *Sutherland	2	3	1	—	3½	5¾	—	—	43	35½	4,446¼	3,936½
32. Wigtown	44½	45¾	1¾	7¼	54½	26¼	24½	—	845½	753	61,658½	53,434½
	1,209¾	1,395½	3,461¼	6,670½	1,998¾	1,429½	1,22[illegible]	—	22,462	26,128¾	1,510,044¼	1,427,790½

* In the counties marked with an asterisk, there are no returns from occupants whose rent is below £20; in the other counties, all at and above a rent of £10 are included.

† Generally Rape.

TABLE No. 2.—Stock.

	Counties.	Horses for Agricultural purposes above 3 years old.	Horses for Agricultural purposes under 3 years old.	All other Horses.	Milk Cows.	Other Cattle.	Calves.	Sheep of all ages for Breeding.	Sheep of all ages for Feeding.	Lands—Produce of 1855.	Swine.	Total Stock. 1855.	Total Stock. 1854.
1.	Aberdeen, . .	16,203	3,362	2,709	34,869	73,995	31,817	38,109	43,230	28,060	8,673	281,027	259,668
2.	Argyle, . . .	3,829	1,790	893	18,796	28,590	12,992	412,934	151,641	249,454	3,458	884,377	731,121
3.	Ayr, ...	6,804	1,812	1,086	39,286	28,809	15,913	123,525	33,444	88,404	12,483	351,566	304,169
4.	Banff, ...	4,405	1,025	705	8,512	17,174	7,947	16,318	9,694	11,729	2,987	80,496	74,859
5.	Berwick, . . .	4,182	1,100	990	3,911	9,569	4,213	91,300	54,448	94,377	4,290	268,380	240,088
6.	Bute, ...	390	208	38	1,592	1,844	964	3,873	2,023	3,018	426	14,376	12,781
	Arran, . . .	299	64	26	1,213	1,142	660	12,925	3,531	9,174	360	29,394	24,797
7.	Caithness, . .	2,004	471	314	3,908	7,013	3,738	29,744	19,093	21,610	1,149	89,044	96,939
8.	Clackmannan, .	721	205	186	1,059	2,704	868	6,896	3,890	4,965	998	22,492	21,235
9.	Dumbarton, . .	1,318	549	319	5,110	5,745	2,289	27,322	12,645	21,075	1,042	77,414	59,432
10.	Dumfries, . .	5,304	1,795	1,317	14,025	24,217	9,613	241,505	37,854	178,631	14,374	528,635	436,866
11.	Edinburgh, . .	3,390	674	938	5,352	8,801	2,749	66,628	26,123	54,792	5,225	174,672	136,282
12.	Elgin, ...	3,526	720	545	5,964	11,162	5,303	28,726	14,171	20,856	4,074	95,047	85,471
13.	Fife, ...	8,224	2,321	1,496	8,739	23,845	8,455	12,708	35,630	12,778	8,863	123,059	128,122
14.	Forfar, . . .	7,447	1,750	1,220	12,266	27,410	11,232	28,989	50,059	22,171	6,383	168,927	169,404
15.	Haddington, . .	3,266	518	697	2,069	5,508	1,627	29,003	29,447	28,403	4,676	105,214	95,546
16.	Inverness, . .	2,330	634	521	8,301	9,758	6,002	285,919	143,156	138,619	1,667	596,907	568,404
17.	Kincardine, . .	3,177	647	554	6,831	13,940	6,653	8,987	12,736	5,394	2,705	61,624	67,269
18.	Kinross, . . .	1,039	522	138	1,599	5,002	2,023	6,869	9,398	6,720	948	34,258	33,366
19.	Kirkcudbright, .	3,745	1,466	862	9,206	24,434	7,118	134,786	44,345	113,517	7,252	346,731	295,124
20.	Lanark, . . .	5,704	1,336	1,425	30,186	20,386	10,129	86,291	21,135	69,193	7,666	253,451	203,582
21.	Linlithgow, . .	1,587	434	313	3,434	5,840	1,975	2,861	8,755	4,029	1,524	30,752	29,539
22.	Nairn, ...	1,410	289	127	2,275	4,137	1,892	21,316	6,914	10,257	1,489	50,106	22,818
23.	Orkney, . . .	1,314	400	185	2,538	3,417	2,173	5,083	1,414	4,318	1,337	22,179	16,734
	Zetland, . . .	74	9	465	298	780	182	3,318	843	1,684	50	7,703	5,985
24.	Peebles, . . .	975	238	199	2,581	3,037	1,736	89,708	21,470	61,533	1,215	182,692	142,720
25.	Perth, ...	10,863	2,844	1,879	22,199	40,739	20,032	248,927	125,455	170,465	9,039	652,442	585,214
26.	Renfrew, . . .	2,272	744	607	11,621	8,297	3,595	10,515	6,139	9,196	1,808	54,794	46,991
27.	Ross and Cromarty,	3,173	723	518	5,008	7,174	4,008	143,859	78,715	65,441	4,557	313,176	276,027
28.	Roxburgh, . . .	3,710	752	1,008	4,462	9,461	4,008	232,559	40,010	176,231	4,271	476,472	377,067
29.	Selkirk, . . .	397	71	122	697	1,012	444	79,135	3,577	52,396	322	138,173	110,239
30.	Stirling, . . .	3,525	1,106	648	8,721	14,533	5,858	42,909	12,919	29,685	2,488	122,392	96,071
31.	Sutherland, . .	565	128	221	1,138	1,849	655	91,443	61,275	47,835	550	205,659	167,783
32.	Wigtown, . . .	4,018	1,393	668	10,697	17,985	8,181	42,960	13,342	32,419	6,001	137,664	121,671
		121,190	32,100	23,939	298,463	469,309	207,044	2,707,950	1,138,521	1,848,429	134,350	6,981,295	6,043,384

TABLE No. 3.—Estimate of Gross Produce per County.

Counties.	Wheat.		Barley.		Oats.		Bere.		Beans and Pease.*		Turnips.		Potatoes.	
	1855.	1854.	1855.	1854.	1855.	1854.	1855.	1854.	1855.	1854.	1855.	1854.	1855.	1854.
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Tons.	Tons.	Tons.	Tons.
1. Aberdeen,	149,106	91,035	230,154	303,149	5,347,118	6,170,688	160,314	204,925	18,266	11,096	1,232,007	1,205,756	42,926	30,645
2. Argyle,	13,394	7,315	46,819	56,795	705,375	806,395	59,093	65,144	21,641	15,147	103,444	84,907	26,412	10,504
3. Ayr,	333,232	313,250	23,342	25,880	2,369,605	2,553,671	10,557	8,038	97,460	98,924	273,168	221,314	34,503	27,675
4. Banff,	31,531	29,640	128,864	160,267	1,273,196	1,599,235	22,546	30,482	7,952	4,552	248,781	250,496	11,174	7,702
5. Berwick,	274,526	292,602	488,549	629,916	1,134,622	1,315,575	2,063	1,273	61,246	47,187	346,703	405,067	16,201	9,935
6. { Bute,	25,399	19,403	5,890	9,678	88,297	110,717	—	—	266	140	18,518	18,111	3,432	1,593
6. { Arran,	4,688	4,373	619	1,974	42,154	49,139	4,655	7,086	3,528	4,403	4,344	6,497	1,493	671
7. Caithness,	5,607	4,644	7,609	9,549	613,799	748,215	56,292	98,924	—	—	120,787	143,416	5,931	8,310
8. Clackmannan,	62,314	59,189	56,984	62,568	133,054	147,800	200	—	44,826	38,434	31,248	26,564	1,701	806
9. Dumbarton,	57,722	48,440	30,624	47,503	341,697	330,084	654	485	19,683	17,246	45,564	37,502	13,673	9,000
10. Dumfries,	71,379	75,148	76,051	98,420	1,480,259	1,633,995	903	616	16,028	16,280	294,237	249,338	29,612	21,741
11. Edinburgh,	273,967	262,128	376,502	454,116	830,915	868,376	6,968	1,582	47,915	48,468	204,988	245,762	39,739	26,212
12. Elgin,	175,170	203,871	280,764	334,378	507,773	595,266	13,104	16,408	7,273	1,856	146,007	149,279	18,585	9,084
13. Fife,	680,557	697,252	873,652	1,075,603	1,475,856	1,656,467	1,201	540	112,467	111,952	434,869	405,445	78,965	68,087
14. Forfar,	434,219	380,658	721,546	908,010	1,676,387	2,001,583	10,047	7,611	21,902	21,067	415,421	407,304	66,302	51,998
15. Haddington,	491,414	540,200	443,060	565,032	764,737	759,922	1,675	1,478	122,261	104,089	245,370	228,599	43,306	33,821
16. Inverness,	37,814	47,573	64,957	93,100	363,176	437,584	21,206	23,068	5,227	2,572	73,948	84,984	12,176	6,519
17. Kincardine,	84,409	72,137	250,742	302,860	990,376	1,244,304	22,043	24,752	16,855	16,497	267,040	225,228	16,888	12,169
18. Kinross,	26,603	13,895	86,017	94,879	252,961	284,081	30	304	3,594	3,724	57,652	67,717	4,215	3,216
19. Kirkcudbright,	42,774	49,276	41,561	60,068	1,007,283	1,068,887	470	946	11,054	14,149	229,108	212,660	13,605	8,372
20. Lanark,	214,665	209,324	70,302	80,158	1,737,931	1,936,027	11,631	8,837	122,259	108,336	158,072	160,564	42,754	34,872
21. Linlithgow,	112,812	89,775	138,961	180,323	379,424	470,256	270	168	48,322	50,707	68,776	73,336	9,915	5,532
22. Nairn,	42,862	51,356	98,914	108,708	199,633	211,129	2,697	1,111	2,814	809	49,137	42,509	5,937	3,573
23. { Orkney,	393	180	2,746	5,727	258,789	238,728	105,525	108,168	—	342	42,536	39,230	6,261	6,532
23. { Zetland,	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24. Peebles,	2,822	1,531	62,330	75,339	338,931	325,448	1,037	927	2,841	48	70,956	84,856	4,505	3,792
25. Perth,	560,594	465,218	536,081	715,380	1,765,435	2,163,572	22,487	15,585	104,437	107,965	392,678	391,575	81,999	63,950
26. Renfrew,	112,943	127,144	15,042	14,436	553,230	584,762	2,477	1,797	46,583	42,795	51,594	40,286	33,207	23,378
27. Ross & Crom.,	233,018	220,179	204,417	264,112	493,042	620,035	6,167	4,604	21,834	8,273	163,834	160,145	20,876	7,281
28. Roxburgh,	183,235	193,291	396,471	509,494	1,027,413	1,121,049	336	120	37,420	30,062	309,438	379,046	9,331	7,956
29. Selkirk,	3,670	1,644	23,018	34,521	112,613	137,385	238	—	569	454	31,525	46,006	1,168	952
30. Stirling,	137,413	107,655	218,006	234,784	693,741	726,932	599	1,520	126,882	124,994	81,700	73,332	18,035	10,295
31. Sutherland,	8,885	10,183	35,759	51,936	80,136	93,637	2,693	1,965	114	—	29,707	32,052	1,633	1,540
32. Wigtown,	173,937	159,170	56,617	76,665	1,042,393	1,082,103	6,769	6,954	30,128	28,695	218,831	212,536	15,710	12,202
	5,063,074	4,848,679	6,092,970	7,645,328	30,081,351	34,093,047	556,957	645,418	1,183,647	1,081,263	6,461,988	6,411,419	732,170	529,915

* The Produce for 1854 was for beans only—that for 1855 embraces beans and pease.

TABLE No. 4.—Estimate of Average Acreable Produce per County.

Counties.	Wheat.				Barley.				Oats.				Bere.				Beans and Pease.*				Turnips.				Potatoes.			
	1855.		1854.		1855.		1854.		1855.		1854.		1855.		1854.		1855.		1854.		1855.		1854.		1855.		1854.	
	Bu.	Pk.	Bu.	Pk.	Bu.	Pk.	Bu.	Pk.	Bu.	Pk.	Bu.	Pk.	Bu.	Pk.	Bu.	Pk.	Bu.	Pk.	Bu.	Pk.	Tn.	Ct.	Tn.	Ct.	Tn.	Ct.	Tn.	Ct.
1. Aberdeen,	27	2¼	28	1	32	1½	37	1	31	1¾	36	0	33	3¼	38	2	29	3	33	2	15	9½	15	9	5	14½	4	5
2. Argyle,	31	1¼	27	2	37	3	34	1	30	3¼	33	1	32	2¼	34	2	29	2½	28	2	16	6	15	2	5	2	1	14
3. Ayr,	25	3¾	28	0	34	0¾	32	1	38	1¾	40	1	36	2½	37	0	27	2¾	28	1	16	11½	14	12	4	4½	3	6
4. Banff,	26	3½	30	0	35	1¼	38	1	30	3	37	1	30	3½	35	1	32	0	34	3	14	5¾	14	11	5	3½	3	5
5. Berwick,	27	2	29	1	32	1¼	38	0	35	2¾	41	1	36	0¾	38	0	26	3¼	28	0	12	17	15	7	7	14	5	5
6. { Bute,	30	2	34	0	38	0¼	39	1	32	3¾	40	0	—		—		23	2½	25	2	15	11¾	16	9	5	9¾	2	7
{ Arran,	25	1½	31	3	34	3½	44	2	25	1½	28	2	34	3½	44	2	22	0¾	31	3	10	6¼	15	18	4	7¼	1	12
7. Caithness,	33	1½	36	0	31	1	36	0	33	2¼	35	2	33	1¾	36	2	—		—		16	9¾	18	10	4	2¼	4	10
8. Clackmannan,	28	0	31	3	32	0	33	0	33	2	37	3	32	0	—		29	1	26	0	17	1	15	14	4	9	2	12
9. Dumbarton,	27	2	29	3	32	0	33	2	34	2	36	0	24	0	33	2	27	0	27	3	17	15	15	10	5	15	3	16
10. Dumfries,	22	0	22	3	29	2	29	3	29	1¼	33	0	26	2¼	26	1	29	3	28	2	14	4½	12	12	4	14	3	0
11. Edinburgh,	30	0¼	32	1	36	2¼	40	2	35	1½	38	0	42	3¼	31	2	30	2	31	1	14	15¾	17	4	5	17¾	4	15
12. Elgin,	24	0	27	2	33	0	37	2	28	1	35	1	26	2	32	0	23	2	33	0	12	4	13	8	5	0	2	4
13. Fife,	25	1	28	3	33	2¾	38	2	33	1¾	38	0	34	3¼	33	1	27	2¾	28	3	15	0	14	10	4	11	4	14
14. Forfar,	26	3	29	3	31	0¾	36	0	32	3¾	39	1	29	3¼	32	1	27	3¼	30	2	12	15½	12	13	4	13	4	3
15. Haddington,	28	0½	32	0	40	3¼	46	3	45	3¼	48	2	38	0¼	36	2	29	3¼	28	3	15	5½	14	18	6	14¼	5	5
16. Inverness,	24	2¼	28	1	29	1	35	0	26	2	32	0	20	3	22	3	22	3	30	0	13	19¾	16	11	4	3½	1	17
17. Kincardine,	30	2	31	0	33	0	38	3	33	1	42	1	32	2	37	1	33	0	34	3	16	0	14	0	5	15	4	12
18. Kinross,	29	1	31	0	30	0	30	1	31	2	34	2	30	0	32	0	22	3	26	3	13	10	16	7	4	0	3	15
19. Kirkcudbright,	24	3¾	26	0	30	0¼	32	2	29	3	33	1	24	3	25	1	27	2¾	30	1	15	15¼	15	15	4	11¾	2	10
20. Lanark,	28	1¼	32	2	34	2	35	0	31	3	34	2	31	2	35	0	29	0¼	29	0	13	18¾	14	15	5	4¼	4	7
21. Linlithgow,	29	3	31	2	34	1	38	3	30	3	36	2	33	3	32	0	28	1	28	3	13	16	15	2	5	3	3	8
22. Nairn,	25	0	27	2	32	2	33	3	25	3	31	3	31	0	35	0	24	0	31	3	11	0	10	10	3	17	2	2
23. { Orkney,	26	0¾	24	0	33	0¾	39	2	32	2	36	3	36	0	37	2	—		35	0	14	2	16	1	4	16¼	6	1
{ Zetland,	—		—		—		—		—		—		—		—		—		—		—		—		—		—	
24. Peebles,	26	3¾	28	2	30	3	35	2	34	2	34	0	38	0¼	35	0	14	0¼	16	0	13	9½	16	0	4	14¼	4	10
25. Perth,	25	1	26	0	27	3	31	2	28	0	34	2	29	0¼	31	0	25	0	28	2	12	10½	12	19	4	10¼	4	0
26. Renfrew,	25	0½	32	0	35	0½	34	1	33	3	35	3	29	1¼	32	1	29	0¾	29	3	15	9½	13	9	6	0	4	5
27. Ross and Cromarty,	26	0	29	1	33	0¼	35	3	30	2¼	37	1	27	3¾	28	1	24	3½	30	2	14	7¾	15	6	4	12¾	1	7
28. Roxburgh,	25	2¾	28	0	31	3¼	38	0	35	0¾	39	2	32	0	20	0	27	2¾	31	1	12	17	15	16	5	6	4	12
29. Selkirk,	31	2	32	1	34	0	37	0	38	0	39	3	34	0	—		17	2	25	1	16	5	22	15	5	19	5	10
30. Stirling,	27	2¼	27	0	32	0¾	32	0	31	0	33	0	33	1¼	32	0	26	2	27	2	13	14	13	10	5	0	3	2
31. Sutherland,	34	1¾	34	0	34	0	38	2	32	2¼	37	0	27	2¾	35	1	8	0	—		16	4	17	6	4	8	3	11
32. Wigtown,	23	2¾	22	0	35	2½	35	3	30	0½	32	2	28	2	29	3	25	2	24	2	14	6¼	15	6	4	1¾	2	11

* The average for 1854 was for beans only—that for 1855 embraces beans and pease.

TABLE No. 5.—Estimate of Average Acreable Produce per District.

DISTRICTS.	Wheat. 1855. Bush.	Wheat. 1855. Pecks.	Wheat. 1854. Bush.	Wheat. 1854. Pecks.	Barley. 1855. Bush.	Barley. 1855. Pecks.	Barley. 1854. Bush.	Barley. 1854. Pecks.	Oats. 1855. Bush.	Oats. 1855. Pecks.	Oats. 1854. Bush.	Oats. 1854. Pecks.	Rye. 1855. Bush.	Rye. 1855. Pecks.	Rye. 1854. Bush.	Rye. 1854. Pecks.
1. Aberdeen.																
District No. 1,	26	2	29	3	31	1	36	2	31	3	37	1	29	—	24	0
District No. 2,	27	2¼	27	0	31	3¼	35	2	29	2½	34	0	19	—	22	0
District No. 3,	28	0½	31	3	33	1½	39	2	31	—	36	1	26	—	25	2
District No. 4,	28	—	28	1	32	2	37	3	32	2	35	1	24	—	28	0
District No. 5,	30	—	33	0	37	3¼	47	0	33	0	37	3	24	—	—	—
2. Argyle.																
District No. 1,	27	—	26	0	38	2	29	2	32	—	26	—	—	—	—	—
District No. 2,	15	3½	—	—	24	3	27	0	25	2¼	24	—	—	—	—	—
District No. 3,	32	1¼	—	—	38	3	29	3	30	—	37	—	—	—	—	—
District No. 4,	32	—	28	2	41	1	36	1	40	—	37	2	6	2	25	1
District No. 5,	—	—	25	2	28	3	36	2	24	0¾	41	1	27	3	28	2
District No. 6,	—	—	—	—	27	—	—	—	23	—	21	—	25	—	—	—
District No. 7,	—	—	—	—	—	—	—	—	30	—	20	—	—	—	—	—
District No. 8,	—	—	—	—	—	—	—	—	14	1	20	—	14	—	—	—
District No. 9,	—	—	—	—	—	—	—	—	28	2¼	28	2	—	—	—	—
District No. 10,	—	—	—	—	—	—	24	—	24	—	32	—	—	—	24	—
3. Ayr.																
District No. 1,	25	1	24	3	32	—	33	2	34	1	35	1	20	—	22	1
District No. 2,	26	3¼	30	1	34	1½	28	1	34	3¾	36	1	32	—	38	0
District No. 3,	26	—	28	0	35	2	30	0	41	—	43	0	30	—	25	0
District No. 4,	29	—	24	1	35	2	33	0	40	2	42	0	31	1	40	0
District No. 5,	24	0¼	32	2	33	2	41	2	43	—	46	3	22	2	20	2
4. Banff.																
District No. 1,	26	2⅞	30	0	37	1⅜	40	1	29	2¼	37	2	22	—	40	0
District No. 2,	28	3	31	0	31	3	35	0	32	1	37	0	—	—	—	—
5. Berwick.																
District No. 1,	27	2	28	3	31	3¼	37	1	34	1½	40	2	—	—	21	0
District No. 2,	27	2	30	1	32	3	38	3	36	3	41	3	16	—	—	—
6. Bute and Arran.																
District No. 1,	30	2	34	0	38	0¼	39	1	32	3¾	40	0	—	—	—	—
District No. 2,	25	1½	31	3	34	3½	44	2	25	1½	28	2	23	3¼	17	2
7. Caithness.																
District No. 1,	32	—	36	—	32	—	36	—	35	—	36	—	—	—	—	—
District No. 2,	34	—	36	—	30	—	36	—	32	—	35	—	—	—	—	—

DISTRICTS.	Bere. 1855. Bush.	Bere. 1855. Pecks.	Bere. 1854. Bush.	Bere. 1854. Pecks.	Beans and Pease.* 1855. Bush.	Beans and Pease.* 1855. Pecks.	Beans and Pease.* 1854. Bush.	Beans and Pease.* 1854. Pecks.	Turnips. 1855. Tons.	Turnips. 1855. Cwts.	Turnips. 1854. Tons.	Turnips. 1854. Cwts.	Potatoes. 1855. Tons.	Potatoes. 1855. Cwts.	Potatoes. 1854. Tons.	Potatoes. 1854. Cwts.	Mangold. 1855. Tons.	Mangold. 1855. Cwts.	Mangold. 1854. Tons.	Mangold. 1854. Cwts.
1. Aberdeen.																				
District No. 1,	32	1	37	1	25	3¼	24	0	15	19	13	14	6	14	4	19	10	—	—	—
District No. 2,	33	0½	38	2	27	0	24	2	16	6¼	14	15	5	9½	4	10	—	—	5	—
District No. 3,	34	3¾	39	0	34	0½	34	1	14	13¾	16	16	5	7	4	3	13	5	—	—
District No. 4,	35	2	37	2	24	1	—	—	14	14	13	0	5	14	3	13	—	—	—	—
District No. 5,	35	3	40	1	20	2	—	—	15	19	19	18	5	15	3	14	12	—	—	—
2. Argyle.																				
District No. 1,	—	—	—	—	30	—	20	—	17	10	14	5	5	10	1	15	16	10	—	—
District No. 2,	25	2¼	—	—	25	3¾	24	—	15	2	10	16	4	11¼	2	15	15	1¼	—	—
District No. 3,	36	3	35	2	26	1	23	—	15	8	14	—	5	2	1	1	16	—	—	—
District No. 4,	42	2	37	2	33	—	29	1	17	4	15	4	5	—	2	16	4	4	—	—
District No. 5,	24	—	38	—	14	1	28	2	14	—	16	10	4	15¼	1	—	15	6	12	—
District No. 6,	30	—	30	—	—	—	—	—	20	10	20	—	7	10	—	10	—	—	—	—
District No. 7,	18	—	24	—	—	—	—	—	5	—	20	—	3	—	1	10	—	—	—	—
District No. 8,	16	1	24	—	—	—	—	—	15	—	20	—	5	10	1	10	—	—	—	—
District No. 9,	33	1¼	31	3	—	—	—	—	9	10¼	11	2	3	11¼	1	5	—	—	—	—
District No. 10,	36	—	24	—	—	—	20	—	18	—	12	—	5	10	—	7	—	—	—	—
3. Ayr.																				
District No. 1,	26	2	31	3	26	1	26	2	15	8	14	1	3	14	2	14	17	5	14	6
District No. 2,	31	0¾	32	3	25	1½	25	1	18	12	13	3	4	11½	3	5	16	1	15	8
District No. 3,	33	0	33	0	28	2	26	2	17	10	15	—	4	15	4	—	14	10	11	10
District No. 4,	36	3	40	0	29	3	35	3	16	—	18	13	4	—	3	16	14	16	15	12
District No. 5,	42	3	40	2	28	2	29	3	16	16	14	7	4	2	2	10	13	13	13	18
4. Banff.																				
District No. 1,	33	2	37	2	32	—	34	3	14	14	14	16	5	1	3	16	—	—	—	—
District No. 2,	30	—	34	2	—	—	—	—	13	14	14	2	5	7	2	8	—	—	—	—
5. Berwick.																				
District No. 1,	30	—	38	0	27	2¼	28	3	12	11	15	2	6	15¾	5	8	18	—	16	—
District No. 2,	39	—	—	—	25	2	26	2	13	2½	15	13	8	13½	5	8	16	5	12	—
6. Bute and Arran.																				
District No. 1,	—	—	—	—	23	2½	25	2	15	11¾	16	9	5	9¾	2	7	15	17½	16	14
District No. 2,	34	3½	44	2	22	0¾	31	3	10	6¼	15	18	4	7¼	1	12	11	2	15	18
7. Caithness.																				
District No. 1,	32	2	35	—	—	—	—	—	15	10	18	—	3	15	4	—	—	—	—	—
District No. 2,	34	—	37	—	—	—	—	—	17	10	19	—	4	10	5	—	—	—	—	—

* The average for 1854 was for beans only—that for 1855 embraces beans and pease.

TABLE No. 5.—Estimate of Average Acreable Produce per District—*Continued.*

DISTRICTS.	WHEAT.				BARLEY.				OATS.				RYE.			
	1855.		1854.		1855.		1854.		1855.		1854.		1855.		1854.	
	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.
8. CLACKMANNAN, ...	28	—	31	3	32	—	33	—	33	2	37	3	28	3	—	—
9. DUMBARTON, ...	27	2	29	3	32	—	33	2	34	2	36	—	—	—	19	—
10. DUMFRIES.																
District No. 1, ...	20	3¼	22	—	28	3	30	2	23	3¾	31	—	—	—	32	—
District No. 2, ...	23	—	23	—	30	2½	30	—	29	1½	34	—	23	3	28	2
District No. 3, ...	19	—	20	—	27	—	27	—	28	2	33	—	20	—	20	—
District No. 4, ...	21	2	22	3	31	—	31	—	32	3	36	1	26	2	27	3
District No. 5, ...	22	1	26	2	23	—	25	1	22	3	27	2	24	—	—	—
11. EDINBURGH.																
District No. 1, ...	31	2	36	—	37	1¾	42	1	35	3¼	37	—	20	—	—	—
District No. 2, ...	31	1¾	33	—	40	0¾	44	3	40	3	45	3	25	1½	—	—
District No. 3, ...	26	0¾	27	1	32	0½	35	—	32	2¾	35	1	—	—	—	—
12. ELGIN, ...	24	—	27	2	33	—	37	2	28	1	35	1	24	2	26	—
13. FIFE.																
District No. 1, ...	25	0¼	25	2	33	3¼	35	2	29	2¼	31	3	—	—	—	—
District No. 2, ...	26	3	28	2	35	—	42	3	34	1	40	1	32	3	31	2
District No. 3, ...	24	1½	27	3	33	1	37	—	35	0½	40	3	22	1	25	1
District No. 4, ...	24	3	30	2	33	—	38	—	33	2	37	3	20	—	24	—
14. FORFAR.																
District No. 1, ...	26	0¾	29	2	31	2¾	35	2	34	3½	38	2	28	2¼	22	1
District No. 2, ...	27	1½	29	3	30	3¼	36	2	31	0¼	40	—	13	3	—	—
15. HADDINGTON.																
District No. 1, ...	2 6	0¼	28	2	36	3	43	—	37	1½	43	—	—	—	—	—
District No. 2, ...	23	3¾	28	2	37	0¼	42	—	41	1¼	41	1	—	—	—	—
District No. 3, ...	28	2¼	35	—	44	1½	54	—	53	3¾	60	1	—	—	—	—
District No. 4, ...	31	2¾	35	—	43	0¾	49	—	57	0¼	60	1	25	1½	31	3
District No. 5, ...	26	3¼	32	—	42	—	49	1	47	2½	54	—	40	1¾	44	1
District No. 6, ...	30	—	32	—	45	3½	44	—	47	1¾	40	—	—	—	—	—
16. INVERNESS.																
District No. 1, ...	25	—	28	—	32	—	36	—	26	—	40	—	26	—	28	—
District No. 2, ...	22	—	36	—	26	—	40	—	25	—	36	—	—	—	—	—
District No. 3, ...	24	—	28	—	28	—	34	—	28	1¼	36	—	32	—	24	—
District No. 4, ...	—	—	—	—	—	—	38	—	30	—	31	1	—	—	—	—
District No. 5, ...	—	—	28	1	36	3¼	35	—	29	1¾	32	—	—	—	19	—

DISTRICTS.	BERE.				BEANS AND PEASE.				TURNIPS.				POTATOES.				MANGOLD.			
	1855.		1854.		1855.		1854.		1855.		1854.		1855.		1854.		1855.		1854.	
	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.
8. CLACKMANNAN, ...	32	—	—	—	29	1	26	—	17	1	15	14	4	9	2	12	15	2	12	—
9. DUMBARTON, ...	24	—	33	2	27	—	27	3	17	15	15	10	5	15	3	16	13	—	15	4
10. DUMFRIES.																				
District No. 1, ...	25	3	24	—	27	2¼	27	—	16	1½	11	8	3	15¼	2	2	13	1¾	11	4
District No. 2, ...	33	—	—	—	31	—	27	—	15	1	16	10	5	1	3	5	16	16	12	10
District No. 3, ...	27	—	24	—	21	—	26	—	15	—	12	—	5	—	3	—	15	—	12	—
District No. 4, ...	24	—	31	3	33	1	32	—	12	4	10	—	5	3	3	2	19	4	12	10
District No. 5, ...	25	—	—	—	20	—	24	3	11	2	9	14	3	5	3	2	5	—	—	—
11. EDINBURGH.																				
District No. 1, ...	—	—	40	—	32	1	32	2	17	11	16	18	5	6	4	5	15	17½	20	—
District No. 2, ...	44	1¾	63	2	34	3½	35	—	18	1¼	19	8	6	11½	5	5	18	0¼	17	8
District No. 3, ...	42	3¼	25	2	26	0¾	27	—	11	18¾	16	4	5	0¾	4	3	11	2	19	10
12. ELGIN, ...	26	2	32	—	23	2	33	—	12	4	13	8	5	—	2	4	10	5	15	—
13. FIFE.																				
District No. 1, ...	—	—	—	—	24	2¼	24	2	15	18	14	5	4	15	3	8	14	5½	11	2
District No. 2, ...	30	—	35	—	30	1	31	2	14	9	15	9	5	3	4	7	15	8	13	16
District No. 3, ...	20	2	37	—	27	3	31	—	14	12	13	7	5	—	4	17	12	12	23	15
District No. 4, ...	38	2	24	—	29	—	29	3	15	8	15	4	4	—	5	—	9	9	8	2
14. FORFAR.																				
District No. 1, ...	31	2¾	31	3	25	1½	31	3	12	13¾	12	1	3	19¼	4	5	11	18	8	—
District No. 2, ...	25	3¼	33	1	28	3	30	—	12	17¼	13	5	5	6¼	4	1	11	12	12	12
15. HADDINGTON.																				
District No. 1, ...	—	—	—	—	27	1½	24	2	14	0¾	14	12	5	12¾	5	2	11	3	11	18
District No. 2, ...	38	0¼	31	3	29	1¾	28	—	14	5½	16	2	6	0½	4	15	9	6¼	11	18
District No. 3, ...	—	—	44	2	31	2¾	28	2	15	17¼	14	5	7	2¾	4	15	14	5½	14	5
District No. 4, ...	—	—	—	—	31	2¾	28	2	17	3½	15	18	6	5½	5	10	17	9½	15	18
District No. 5, ...	38	0¼	—	—	29	3½	31	1	15	2¾	14	12	7	3½	6	—	21	3½	15	10
District No. 6, ...	—	—	—	—	29	1½	32	—	15	12¾	14	—	7	16½	5	—	29	12½	—	—
16. INVERNESS.																				
District No. 1, ...	30	—	24	—	24	—	30	—	10	—	12	—	4	—	1	10	8	—	—	—
District No. 2, ...	26	—	48	—	20	—	—	—	16	—	20	—	3	10	1	7	11	—	—	—
District No. 3, ...	32	—	34	—	20	—	—	—	15	—	20	—	4	—	2	—	12	—	—	—
District No. 4, ...	30	—	38	—	—	—	—	—	14	12	16	3	4	7	2	16	—	—	—	—
District No. 5, ...	40	—	22	3	—	—	—	—	16	—	16	11	5	17¼	1	17	—	—	—	—

Table No. 5.—Estimate of Average Acreable Produce per District—*Continued.*

DISTRICTS.	Wheat.				Barley.				Oats.				Rye.			
	1855.		1854.		1855.		1854.		1855.		1854.		1855.		1854.	
	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.
16. Inverness—*Continued.*																
District No. 6,	—	—	—	—	19	3¼	22	1	21	1¾	16	3	—	—	—	—
District No. 7,	—	—	—	—	—	—	24	—	9	—	30	—	—	—	—	—
District No. 8,	—	—	—	—	—	—	19	—	12	2¾	12	2	14	1	14	1
District No. 9,	—	—	—	—	—	—	20	—	12	2¾	16	—	11	0½	16	—
District No. 10,	—	—	—	—	—	—	19	—	—	—	12	2	—	—	14	1
District No. 11,	—	—	—	—	—	—	—	—	—	—	20	2	—	—	—	—
17. Kincardine,	30	2	31	—	33	—	38	3	33	1	42	1	26	3	28	3
18. Kinross,	29	1	31	—	30	—	30	1	31	2	34	2	25	—	20	—
19. Kirkcudbright.																
District No. 1,	24	2¼	26	2	30	0½	31	2	28	3¼	33	2	26	3¾	26	3
District No. 2,	25	—	27	—	28	—	29	—	32	—	35	—	—	—	—	—
District No. 3,	26	0¾	23	—	32	1¼	37	1	28	3	32	—	29	1¼	19	—
District No. 4,	—	—	—	—	23	1	28	—	29	2	29	—	19	—	—	—
20. Lanark.																
District No. 1,	28	2¼	32	3	35	1¼	35	2	35	1½	36	1	30	0½	—	—
District No. 2,	25	1½	28	2	32	2	34	—	26	3¾	31	3	30	0½	23	3
21. Linlithgow,	29	3	31	2	34	1	38	3	30	3	36	2	—	—	—	—
22. Nairn,	25	—	27	2	32	2	33	3	25	3	31	3	30	—	33	1
23. Orkney.																
District No. 1,	27	—	—	—	—	—	32	—	31	3½	34	3	—	—	—	—
District No. 2,	24	—	24	—	33	0¾	41	3	35	1	39	2	—	—	—	—
District No. 3,	—	—	—	—	—	—	—	—	21	3¾	30	—	—	—	—	—
Zetland,	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24. Peebles,	26	3¾	28	2	30	3	35	2	34	2	34	0	—	—	17	3
25. Perth.																
District No. 1,	27	3¾	28	—	27	2¾	34	1	30	3½	41	2	22	0¾	—	—
District No. 2,	27	2	26	0	31	—	31	0	31	1	33	2	—	—	28	0
District No. 3,	20	1	22	0	23	—	29	2	23	1½	32	3	16	2½	13	2
District No. 4,	25	2½	24	3	29	1¼	31	1	27	1	37	2	19	—	16	0
District No. 5,	22	1¼	25	2	23	2¾	29	1	26	3	32	2	—	—	—	—
District No. 6,	22	3⅕	26	0	22	2	28	0	24	0	28	1	28	1	—	—

DISTRICTS.	Bere.				Beans and Pease.				Turnips.				Potatoes.				Mangold.			
	1855.		1854.		1855.		1854.		1855.		1854.		1855.		1854.		1855.		1854.	
	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.
16. Inverness—*Continued.*																				
District No. 6,	19	3¼	22	1	—	—	—	—	17	9	16	—	3	17	—	16	—	—	—	—
District No. 7,	10	—	30	—	—	—	—	—	6	—	18	—	2	—	5	—	—	—	—	—
District No. 8,	19	—	19	—	—	—	—	—	14	5½	14	5	3	11¼	3	10	—	—	—	—
District No. 9,	15	3½	20	—	—	—	—	—	12	13¾	14	5	3	11¼	4	15	—	—	—	—
District No. 10,	—	—	19	—	—	—	—	—	—	—	14	5	—	—	3	10	—	—	—	—
District No. 11,	—	—	24	—	—	—	—	—	—	—	—	—	—	—	1	10	—	—	—	—
17. Kincardine,	32	2	37	1	33	—	34	3	16	—	14	—	5	15	4	12	12	—	12	—
18. Kinross,	30	—	32	—	22	3	26	3	13	10	16	7	4	—	3	15	16	—	—	—
19. Kirkcudbright.																				
District No. 1,	—	—	22	1	31	0¾	32	1	14	15¼	14	15	4	16¼	2	13	14	13½	15	12
District No. 2,	—	—	—	—	26	—	32	—	16	8	15	—	4	15	2	—	12	—	14	—
District No. 3,	26	3¾	25	2	23	3¼	25	2	17	1	19	—	3	12¼	2	8	15	1¼	11	2
District No. 4,	23	2	—	—	24	—	—	—	13	6	11	10	5	1½	2	10	—	—	—	—
20. Lanark.																				
District No. 1,	30	0½	—	—	29	3	29	—	15	10	14	8	5	17¼	4	11	14	5½	15	6
District No. 2,	32	2	35	—	24	2¾	28	2	12	13¼	15	—	3	19¼	4	—	11	18	19	—
21. Linlithgow,	33	3	32	—	28	1	28	3	13	16	15	2	5	3	3	8	12	13	11	6
22. Nairn,	31	—	35	—	24	—	31	3	11	—	10	10	3	17	2	2	16	—	—	—
23. Orkney.																				
District No. 1,	36	2¼	31	3	—	—	—	—	12	12¼	13	19	4	16¼	6	10	—	—	—	—
District No. 2,	36	1	39	—	—	—	35	—	14	12	17	—	4	16¼	5	5	—	—	—	—
District No. 3,	31	2¼	36	1	—	—	—	—	17	10¼	17	8	4	16	8	6	—	—	—	—
Zetland,	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24. Peebles,	38	0¼	35	—	14	0¼	16	—	13	9½	16	—	4	14¼	4	10	7	2¾	12	12
25. Perth.																				
District No. 1,	—	—	—	—	25	—	33	0	13	19½	13	12	4	18¼	4	3	14	5	13	10
District No. 2,	21	—	—	—	24	—	26	0	11	4	13	5	4	5	3	16	9	—	8	—
District No. 3,	23	3¼	—	—	17	1¾	22	3	9	8¾	10	5	3	1	3	9	—	—	—	—
District No. 4,	34	0½	—	—	24	3	29	2	14	—	15	9	5	0¾	4	5	—	—	—	—
District No. 5,	—	—	—	—	22	0¾	23	2	10	19¾	11	5	4	1¾	3	9	9	10¼	9	10
District No. 6,	—	—	16	—	26	3⅕	26	0	14	—	12	9	4	15	3	11	20	—	16	—

TABLE No. 5.—Estimate of Average Acreable Produce per District—*Continued.*

DISTRICTS.	Wheat 1855. Bush.	Wheat 1855. Pecks.	Wheat 1854. Bush.	Wheat 1854. Pecks.	Barley 1855. Bush.	Barley 1855. Pecks.	Barley 1854. Bush.	Barley 1854. Pecks.	Oats 1855. Bush.	Oats 1855. Pecks.	Oats 1854. Bush.	Oats 1854. Pecks.	Rye 1855. Bush.	Rye 1855. Pecks.	Rye 1854. Bush.	Rye 1854. Pecks.
25. PERTH—*Continued.*																
District No. 7,	29	—	33	3	31	—	35	0	31	3	38	2	20	—	—	—
District No. 8,	30	1	33	1	27	—	34	1	29	3	38	3	18	—	28	3
District No. 9,	24	2	26	0	32	—	35	0	31	—	38	2	18	—	—	—
26. RENFREW.																
District No. 1,	28	3	34	2	37	1	33	0	36	3	39	0	—	—	—	—
District No. 2,	23	2	33	0	32	2	33	1	33	2¼	36	3	—	—	—	—
District No. 3,	26	1¼	28	2	35	2¾	38	0	35	2¾	38	0	25	1½	—	—
District No. 4,	29	0½	30	0	26	3¾	23	3	24	2¼	23	3	26	3¾	—	—
27. ROSS AND CROMARTY.																
District No. 1,	25	—	28	—	35	—	36	—	33	2	36	—	24	—	23	—
District No. 2,	27	—	30	3	32	—	36	—	29	—	39	3	26	—	—	—
District No. 3,	—	—	—	—	—	—	—	—	32	2	23	3	—	—	—	—
District No. 4,	—	—	—	—	32	—	32	—	30	—	30	—	—	—	—	—
District No. 5,	—	—	—	—	28	1¼	—	—	28	1¼	20	—	—	—	—	—
District No. 6,	—	—	—	—	—	—	—	—	26	—	30	—	—	—	—	—
28. ROXBURGH.																
District No. 1,	27	3	30	2	36	—	41	—	40	1	43	—	—	—	30	—
District No. 2,	26	—	27	3	30	—	38	3	35	—	41	2	24	—	24	—
District No. 3,	25	3	29	1	32	2	38	—	38	3	42	—	24	—	29	—
District No. 4,	24	1½	25	1	30	2¼	38	—	36	1	41	—	—	—	—	—
District No. 5,	23	1½	25	1	30	—	36	1	32	2	36	1	—	—	—	—
District No. 6,	29	—	29	3	30	—	35	3	32	—	38	2	—	—	—	—
District No. 7,	—	—	—	—	27	—	34	—	32	—	36	—	—	—	—	—
29. SELKIRK,	31	2	32	1	34	—	37	—	38	—	39	3	—	—	—	—
30. STIRLING.																
District No. 1,	27	2¼	27	—	33	1½	33	1	32	2¾	35	2	—	—	23	3
District No. 2,	27	2	27	2	27	—	27	—	28	1½	29	—	—	—	—	—
31. SUTHERLAND.																
District No. 1,	—	—	—	—	—	—	43	1	30	—	38	1	—	—	—	—
District No. 2,	—	—	—	—	32	—	28	—	26	2	30	3	—	—	—	—
District No. 3,	28	—	24	—	34	—	38	3	30	3½	35	1	—	—	20	—
District No. 4,	37	—	38	—	34	—	38	1	38	—	41	1	20	—	—	—
32. WIGTOWN.																
District No. 1,	26	3¾	23	2	36	3¼	36	3	33	2¾	35	1	28	2¼	—	—
District No. 2,	22	1½	21	2	26	3¾	29	2	26	3	29	2	27	0¾	30	—

DISTRICTS.	Bere 1855. Bush.	Bere 1855. Pecks.	Bere 1854. Bush.	Bere 1854. Pecks.	Beans and Pease 1855. Bush.	Beans and Pease 1855. Pecks.	Beans and Pease 1854. Bush.	Beans and Pease 1854. Pecks.	Turnips 1855. Tons.	Turnips 1855. Cwts.	Turnips 1854. Tons.	Turnips 1854. Cwts.	Potatoes 1855. Tons.	Potatoes 1855. Cwts.	Potatoes 1854. Tons.	Potatoes 1854. Cwts.	Mangold 1855. Tons.	Mangold 1855. Cwts.	Mangold 1854. Tons.	Mangold 1854. Cwts.
25. PERTH—*Continued.*																				
District No. 7,	32	—	31	3	25	—	33	2	11	10	13	4	5	4	4	17	15	—	14	—
District No. 8,	25	3	34	3	17	—	31	0	17	13	17	7	5	0½	6	8	—	—	—	—
District No. 9,	28	—	—	—	23	—	28	2	13	2	12	12	4	10	3	2	—	—	—	—
26. RENFREW.																				
District No. 1,	—	—	33	0	36	—	30	3	15	5	13	4	6	2	3	14	12	—	12	—
District No. 2,	30	3¾	33	1	27	2	28	1	16	—	13	6	6	2	5	2	15	1½	11	12
District No. 3,	28	2¼	38	0	27	2¼	31	3	17	12	16	0	6	10	4	15	7	2¾	13	10
District No. 4,	30	0½	23	3	22	0¾	22	1	11	2	9	10	3	19¼	1	12	7	18½	—	—
27. ROSS AND CROMARTY.																				
District No. 1,	24	—	26	—	25	1½	31	—	15	—	16	—	4	7	1	5	10	—	10	—
District No. 2,	—	—	—	—	24	2	29	3	13	18	15	—	4	17	1	7	8	—	—	—
District No. 3,	35	—	31	3	15	—	—	—	15	—	5	10	5	—	1	5	—	—	—	—
District No. 4,	28	—	32	—	30	—	—	—	14	—	25	—	3	10	3	10	—	—	—	—
District No. 5,	26	2½	24	—	—	—	—	—	16	10½	16	—	4	9	1	—	—	—	—	—
District No. 6,	28	—	30	—	—	—	—	—	14	—	6	—	6	—	2	—	—	—	—	—
28. ROXBURGH.																				
District No. 1,	—	—	—	—	30	—	30	—	14	—	16	—	6	15	6	—	12	—	10	—
District No. 2,	—	—	—	—	26	—	30	—	11	—	15	—	7	—	5	—	—	—	—	—
District No. 3,	—	—	—	—	35	—	37	—	14	4½	16	7	6	—	5	13	10	—	9	—
District No. 4,	—	—	—	—	29	3	36	3	11	12½	14	—	4	12¾	3	5	14	—	10	—
District No. 5,	31	2¼	—	—	23	2½	29	3	12	3½	17	5	4	6	4	10	8	—	—	—
District No. 6,	36	—	20	—	28	—	24	—	14	10	15	2	4	14	4	—	5	—	—	—
District No. 7,	—	—	—	—	—	—	—	—	12	10	13	—	4	10	2	10	—	—	—	—
29. SELKIRK,	34	—	—	—	17	2	25	1	16	5	22	15	5	19	5	10	—	—	—	—
30. STIRLING.																				
District No. 1,	33	1¼	33	1	27	0½	28	—	13	13	13	17	4	16	3	16	—	—	—	—
District No. 2,	—	—	27	—	23	1½	24	2	13	16¾	12	16	5	4	2	10	—	—	—	—
31. SUTHERLAND.																				
District No. 1,	33	1	43	1	30	—	—	—	14	10	16	3	4	—	4	17	—	—	—	—
District No. 2,	31	—	28	—	—	—	—	—	13	15	16	—	6	—	4	—	—	—	—	—
District No. 3,	28	—	35	2	8	—	—	—	12	18	14	7	4	12	3	7	—	—	—	—
District No. 4,	18	—	30	0	—	—	—	—	21	—	21	1	3	10	3	9	—	—	—	—
32. WIGTOWN.																				
District No. 1,	36	2	41	—	24	2¼	25	2	14	5½	17	—	5	3	3	16	13	5½	10	5
District No. 2,	28	0½	28	2	26	3¾	23	3	14	7	13	18	3	4¼	1	12	13	11¼	12	—

LIST OF DISTRICTS.

1.—County of Aberdeen.

District No. 1.—(Mar.) Parishes of Aboyne, Alford, Birse, Cluny, Coul, Crathie, Drumoak, Dyce, Echt, Glenmuick, Kemnay, Kincardine-O'Neil, Kinnellor, Leochel-Cushnie, Logie-Coldstone, Lumphanan, Mid-Mar, Monymusk, Newhills, Peterculter, Skene, Strathdon, Tarland, Tough, and Towie. *Enumerator*, Robert Williamson, Bendauch, Blackburn, Aberdeen.

2.—(Formartine.) Belhelvie, Bourtie, Ellon, Fintray, Foveran, Keith-hall, Logie-Buchan, New Machar, Old Machar, Methlic, Meldrum, Slains, Tarves, and Udny. *Enumerator*, Robert Copland, Haddo House, Methlic.

3.—(Buchan.) Aberdour, Crimond, Cruden, Old Deer, New Deer, Fraserburgh, King Edward, Longside, Lonmay, Monquhitter, Peterhead, Pitsligo, Rathen, Strichen, St Fergus and Tyrie. *Enumerator*, John Ferguson, Coynach, Ellon.

4.—(Garioch.) Auchterless, Chapel of Garioch, Culsalmond, Daviot, Fyvie, Insch, Inverury, Kintore, Leslie, Oyne, Premnay, Rayne, and Turriff. *Enumerator*, George Philip, Boynds, Keith Hall.

5.—(Strathbogie.) Auchindoir, Cairney, Clatt, Drumblade, Forgue, Gartly, Glass, Glenbucket, Huntly, Keig, Kildrummy, Kinnethmont, Rhynie, and Tullynessle. *Enumerator*, William Murdoch, Huntly.

2.—County of Argyle.

District No. 1.—(Cowal.) Dunoon and Kilmun, Inverchoalin, Kilfinnan, Kilmodan or Glendaruel, Lochgoilhead, and Strachur and Stralachlan. *Enumerator*, Archibald M'Farlane, Clachan, Cairndow.

2.—(Argyle.) Craignish, Glassary, Inverary, Kilmartin, North Knapdale, and South Knapdale. *Enumerator*, Neil M'Kechnie, Inverary.

3.—(Lorn.) Lismore and Appin, Ardchattan and Mucharn, Glenorchy and Inishail, Kilchattan and Kilbrandon, Kilbride and Kilmore, Kilninver and Kilmelfort, Kilchrennan and Dalavich, and Argyleshire portion of Kilmallie. *Enumerator*, Duncan M'Arthur, Penningfair, Oban.

4.—(Kintyre.) Campbeltown, Gigha, Kilcalmonell and Kilberry, Killean and Kilkenzie, Southend, and Saddell and Skipness. *Enumerator*, Peter Watson, Campbelltown.

5.—(Islay.) Bowmore or Killarrow, Kilchoman, Kildalton, and Kilmeny. *Enumerator*, Archibald M'Donald, Ardnave, Bowmore.

6.—(Mull.) Kilfinichen and Kilmachewan, Kilmore and Kilninian, and Torosay and Pennygowan. *Enumerator*, D. A. M'Diarmid, Kilfinichen, Mull.

7.—Coll. *Enumerator*, John Campbell, Cornaig, Coll.

8.—Tyree. *Enumerator*, Donald Campbell, Reef Cottage, Tyree.

9.—Jura and Colonsay. *Enumerator*, Neil M'Leod, Feolin, Jura.

10.—Morven, and Argyleshire portion of Ardnamurchan. *Enumerator*, John A. Sellar, Ardtornish, Morven.

3.—County of Ayr.

District No. 1.—Ballantrae, Barr, Colmonell, Dailly, Girvan, Kirkmichael, Kirkoswald, Maybole, and Straiton. *Enumerator*, Alexander Ralston, Lagg, Ayr.

2.—Auchinleck, Ayr, Coylton, Dalrymple, Dalmellington, Muirkirk, New Cumnock, Old Cumnock, Ochiltree, and Stair. *Enumerator*, James Drennan, Holehouse, Ayr.

3.—Craigie, Dundonald, Galston, Mauchline, Monkton and Prestwick, Newton, Riccarton, St Quivox, Sorn, Symington, and Tarbolton. *Enumerator*, Thomas Reid, Monkton Mill, Ayrshire.

4.—Ardrossan, Beith, Dalry, West Kilbride, Kilbirnie, Kilwinning, Largs, and Stevenston. *Enumerator*, David Cuninghame, Chapelton, Ardrossan.

5.—Dreghorn, Dunlop, Fenwick, Irvine, Kilmarnock, Kilmaurs, Loudon, and Stewarton. *Enumerator*, John Guthrie, Holms, Kilmarnock.

4.—County of Banff.

District No. 1.—Alvah, Banff, Bellie, Boyndie, Cullen, Fordyce, Forglen, Gamrie, Inverkeithny, Marnoch, Ordiquhill, and Rathven. *Enumerator*, George Williamson, Auldtown, Turriff.

2.—Aberlour, Boharm, Botriphnie, Cabrach, Deskford, Grange, Inveravon, Keith, Kirkmichael, Mortlach, and Rothiemay. *Enumerator*, James Black, Knock, Keith.

5.—County of Berwick.

District No. 1.—Abbey St Bathans, Ayton, Buncle and Preston, Cockburnspath, Cranshaws, Coldingham, Chirnside, Edrom, Eyemouth, Foulden, Hutton, Ladykirk, Longformacus, Mordington, Swinton, and Whitsome. *Enumerator*, John Wilson, Edington Mains, Chirnside.

2.—Channelkirk, Coldstream, Dunse, Earlstone, Eccles, Fogo, Gordon, Greenlaw, Hume, Langton, Lauder, Legerwood, Mertown, Nenthorn, Polwarth, and Westruther. *Enumerator*, Robert Logan, Woodend, Dunse.

6.—County of Bute.

District No. 1.—(Bute.) Kingarth, North Bute, Rothesay, and Meikle and Little Cumbray. *Enumerator*, Samuel Girdwood, Little Kilmory, Rothesay.

2.—(Arran.) Kilmory, and Kilbride. *Enumerator*, James Allan, Clauchan, Arran.

7.—County of Caithness.

District No. 1.—Bower, Latheron, Watten, and Wick. *Enumerator*, George Brown, Watten Mains, Wick.

2.—Canisby, Dunnet, Halkirk, Olrig, Reay (in Caithness), and Thurso. *Enumerator*, Alexander Henderson, younger of Stempster, Thurso.

8.—County of Clackmannan.

Alloa, Clackmannan, Dollar, Logie, Tillicoultry, and Tulliallan (in Perth). *Enumerator*, Thomas Ritchie, Bowhouse, Alloa.

9.—County of Dumbarton.

Arrochar, Bonhill, Cardross, Cumbernauld, Dumbarton, Kilmaronock, East Kilpatrick, West Kilpatrick, Kirkintilloch, Luss, Rosneath, and Row. *Enumerator*, Lorne Campbell, Roseneath.

10.—County of Dumfries.

District No. 1.—(Upper Annandale.) Applegarth, Dryfesdale, Hutton, Johnstone, Kirkpatrick-Juxta, Lochmaben, Moffat, St Mungo, Tundergarth, and Wamphray. *Enumerator*, Robert Elliot, Hardgrave, Lockerbie.

2.—(Lower Annandale.) Annan, Cummertrees, Dalton, Dornock, Gretna, Hoddam, Kirkpatrick-Fleming, Middlebie, Mousewald, and Ruthwell. *Enumerator*, Bradshaw Barker, Wysebyhill, Ecclefechan.

3.—(Upper Nithsdale.) Closeburn, Durrisdeer, Glencairn, Keir, Kirkconnell, Morton, Penpont, Sanquhar, and Tynron. *Enumerator*, James Grierson, Morton Mains, Thornhill.

4.—(Lower Nithsdale.) Caerlaverock, Dumfries, Dunscore, Holywood, Kirkmahoe, Kirkmichael, Tinwald, and Torthorwald. *Enumerator*, James W. Paterson, Pearmount, Dumfries.

5.—(Eskdale.) Canonbie, Eskdalemuir, Ewes, Half-Morton, Langholm, and Westerkirk. *Enumerator*, James Church, Tower of Sark, Canonbie.

11.—County of Edinburgh.

District No. 1.—Mid-Calder, West-Calder, Corstorphine, Cramond, Currie, Kirknewton, South Leith, North Leith, and Ratho. *Enumerator*, Peter M'Lagan, yr. of Pumpherston, Mid-Calder.

2.—Colinton, Dalkeith, Duddingston, Glencorse, Inveresk, Lasswade, Liberton, Newton, and St Cuthberts. *Enumerator*, John Finnie, Swanston, Edinburgh.

3.—Borthwick, Carrington, Cockpen, Cranston, Crichton, Fala, Heriot, Newbattle, Penicuik, Temple, and Stow. *Enumerator*, James M'Lean, Braidwood, Penicuik.

12.—County of Elgin.

Abernethy, Alves, Birnie, Cromdale, Dallas, Drainy, Duffus, Duthil, Dyke, Edinkillie, Elgin, Forres, Kinloss, Knockando, St Andrews-Lhanbride, New Spynie, Rafford, Rothes, Speymouth, and Urquhart. *Enumerator*, James Geddes, Orbliston, Fochabers.

13.—County of Fife.

District No. 1.—Beath, Carnock, Culross (in Perthshire), Dalgetty, Dunfermline, Inverkeithing, Saline, and Torryburn. *Enumerator*, R. E. Beveridge, Urquhart, Dunfermline.

2.—Abbotshall, Aberdour, Auchterderran, Auchtertool, Ballingry, Burntisland, Dysart, Kennoway, Kinghorn, Kinglassie, Kirkaldy, Leslie, Markinch, Scoonie, and Wemyss. *Enumerator*, James B. Fernie of Kilmux, Kennoway.

3.—Abdie, Auchtermuchty, Balmerino, Ceres, Collessie, Creich, Cults, Cupar, Dairsie, Dunbog, Falkland, Flisk, Kettle, Kilmany, Logie, Monimail, Moonzie, Newburgh, and Strathmiglo. *Enumerator*, William Dingwall, Ramornie, Ladybank.

4.—Anstruther (Easter and Wester), Cameron, Carnbee, Crail, Denino, Elie, Ferry-Port-on-Craig, Forgan, Kemback, Kilconquhar, Kilrenny, Kingsbarns, Largo, Leuchars, Newburn, Pittenweem, St Andrews, St Leonards, and St Monance. *Enumerator*, James Balfour, Milton, Leuchars.

14.—County of Forfar.

District No. 1.—Airlie, Arbirlot, Auchterhouse, Barry, Cortachy, Dundee, Eassie and Nevy, Glammis, Glenisla, Inverarity, Kettins, Kingoldrum,

Kinettles, Kirriemuir, Liff and Benvie, Lintrathen, Lundie and Fowlis Easter, Mains and Strathmartin, Monifieth, Monikie, Murroes, Newtyle, Panbride, Ruthven, and Tealing. *Enumerator*, John Alexander, Mains of Glammis.

2.—Aberlemno, Arbroath, Brechin, Caraldstone, Carmylie, Craig, Dun, Dunnichen, Edzell, Farnell, Fern, Forfar, Guthrie, Inverkeillor, Kinnell, Kirkden, Lethnot, Lochlee, Logie-Pert, Lunan, Marytoun, Menmuir, Montrose, Oathlaw, Rescobie, St Vigeans, Stracathro, and Tannadyce. *Enumerator*, Robert Hector, Kintrockat, Brechin.

15.—County of Haddington.

District No. 1.—Haddington, Gifford, Garvald, Bolton, and Morham. *Enumerator*, George Harvey, Whittingham Mains, Prestonkirk.

2.—Humbie, Ormiston, Pencaitland, and Salton. *Enumerator*, Henry M. Davidson, Holyn Bank, Haddington.

3.—Gladsmuir, Prestonpans, and Tranent. *Enumerator*, David Wright, Southfield, Gladsmuir.

4.—Aberlady, Athelstaneford, Dirleton, and North Berwick. *Enumerator*, George Hope, Fenton Barns, Drem.

5.—Prestonkirk, Stenton, Whitekirk, and Whittingham. *Enumerator*, Mathew Buist, Tynninghame, Prestonkirk.

6.—Dunbar, Innerwick, Oldhamstocks, and Spott. *Enumerator*, P. H. Hume, Lawfield, Dunbar.

16.—County of Inverness.

District No. 1.—Kilmorack Kiltarlity, and Kirkhill. *Enumerator*, John Peter, Croyard, Beauly.

2.—Urquhart and Glenmoriston. *Enumerator*, John Sinclair, Borlumbeg, Drumnadrochit.

3.—Abertarff and Boleskine, Daviot, Dores, and Inverness and Bona. *Enumerator*, Hugh Fraser, Balloch, Inverness.

4.—Alvie, Kingussie, Laggan, and Rothiemurchus. *Enumerator*, James M'Pherson, Biallid, Kingussie.

5.—Ardnamurchan (Inverness-shire part), Glenelg, Kilmallie, (Inverness-shire part), and Kilmonivaig. *Enumerator*, Thomas Macdonald, Fort-William.

6.—(Skye.) Bracadale, Duirnish, Kilmuir, Portree and Rasay, Sleat, Snizort, and Strath. *Enumerator*, Robert Ballingal, Portree.

7.—Harris and Bernera. *Enumerator*, Kenneth Macdonald, Scaristavore, Lochmaddy.

8.—North Uist. *Enumerator*, Alexander Macdonald, Balranald, Lochmady.

9.—South Uist. *Enumerator*, Norman Macdonald, Nunton, Lochmaddy.

10.—Barra. *Enumerator*, Dr M'Gillivray, Eoligary, Lochmaddy.

11.—Small Isles.

17.—County of Kincardine.

Arbuthnot, Banchory-Devenick, Banchory-Ternan, Benholm, Bervie, Dunottar, Duris, Fettercairn, Fetteresso, Fordoun, Garvock, Glenbervie, Kinneff, Laurencekirk, Maryculter, Marykirk, Nigg, St Cyrus, and Strachan. *Enumerator*, James Farquharson, Auchinblae.

18.—County of Kinross.

Arngask, Cleish, Fossoway, Kinross, Orwell, and Portmoak. *Enumerator,* Andrew Douie, Blair-Adam.

19.—Stewartry of Kirkcudbright.

District No. 1.—Colvend, Irongray, Kirkbean, Kirkpatrick-Durham, Kirkgunzeon, Lochrutton, New Abbey, Terregles, Troqueer, and Urr. *Enumerator,* Thomas Lawrie, Terregleston, Dumfries.

2.—Buittle, Crossmichael, Kelton, Kirkcudbright, Parton, and Rerrick. *Enumerator,* Robert M'Knight of Barlochan, Castle Douglas.

3.—Anworth, Balmaghie, Borgue, Girthon, Kirkmabreck, Minnigaff, Tongland, and Twynholm. *Enumerator,* Walter M'Culloch of Kirkclaugh, Gatehouse.

4.—Balmaclellan, Carsphairn, Dalry and Kells. *Enumerator,* James Barbour of Bogue, Castle Douglas.

20.—County of Lanark.

District No. 1.—Avondale, Barony, Blantyre, Bothwell, Cadder, Cambuslang, Cambusnethan, Carmunnock, Dalserf, Dalziel, Glasgow, Glassford, Govan, Hamilton, East-Kilbride, New Monkland, Old Monkland, Rutherglen, Shotts, and Stonehouse. *Enumerator,* William Forrest, of Treesbanks, Allanton, Hamilton.

2.—Biggar, Carluke, Carmichael, Carnwath, Carstairs, Covington, Crawford, Crawfordjohn, Culter, Dolphinton, Douglas, Dunsyre, Lanark, Lesmahagow, West-Liberton, Pittenain, Symington, Walston, Wandell and Lamington, and Wiston and Roberton. *Enumerator,* James Brown, Liberton Mains, Lanark.

21.—County of Linlithgow.

Abercorn, Bathgate, Borrowstowness, Carriden, Dalmeny, Ecclesmachan, Kirkliston, Linlithgow, Livingston, Torphichen, Uphall, and Whitburn. *Enumerator,* Robert J. Thomson, Hangingside, Linlithgow.

22.—County of Nairn.

Ardclach, Auldearn, Ardersier, Cawdor, Croy, Nairn, Moy, and Petty. *Enumerator,* James Mitchell, Mills of Nairn, Nairn.

23.—County of Orkney.

District No. 1.—(Mainland.) Birsay and Harray, Evie and Rendal, Firth and Stennis, Orphir, Kirkwall or St Ola, Holm, St Andrew and Deerness, Sandwick, and Stromness. *Enumerators,* George Folsetter, Evie; George Frisken, Mill of Kirbuston, Orphir; Robert Armit, Kirkwall; and William Watt, Skaill.

District No. 2.—(North Isles.) Cross and Burness, Lady and Sanday, North Ronaldshay, Eday and Phara, Shapinshay, Stronsay, Rousay and Egilshay, Westray, and Papa Westray. *Enumerators,* Jerome Dennison, West Brough; George Davidson, Greentoft; James Fullarton, Strathor; John Forbes, Stronsay; George Learmonth, Westness; and Thomas Traill of Holland.

District No. 3.—(South Isles.) Hoy and Graemsay, Walls, &c., South Ronaldshay, and Flotta. *Enumerators,* William Banks, Walls; and William Cromarty, South Ronaldshay.

ZETLAND.

The Islands of Zetland. *Enumerator*, Charles G. Duncan, Lerwick.

24.—COUNTY OF PEEBLES.

Broughton, Drumelzier, Eddlestone, Innerleithen, Kirkurd, Linton, Lyne and Megget, Manor, Newlands, Peebles, Skirling, Stobo, Traquair, and Tweedsmuir. *Enumerator*, James Murray, Drochil Castle, Noblehouse.

25.—COUNTY OF PERTH.

District No. 1.—Abernyte, Errol, Inchture, Kilspindie, Kinfauns, Kinnaird, Longforgan, and St Madoes. *Enumerator*, James Young, Cairney Mill, Perth.

2.—Abernethy, Auchterarder, Dron, Dumbarney, Dunning, Forteviot, Forgandenny, Glendovan, Muckhart, and Muthill. *Enumerator*, Thomas W. Lorimer, Belkie, Auchterarder.

3.—Caputh, Cargill, Collace, Kinnoull, Lethendy, Scone, and St Martins. *Enumerator*, John M. Matthew, Colin, Perth.

4.—Auchtergaven, Kinclaven, Moneydie and Logiealmond, Methven, Perth, Redgorton and Stanley, Rhind, and Tibbermuir. *Enumerator*, Thomas Wylie of Airliewight, Bankfoot, Perth.

5.—Aberdalgie, Comrie, Crieff, Fowlis Wester, Gask, Madderty, Monzie, Monzievaird, and Trinity-Gask. *Enumerator*, Thomas Ross, Bachilton, Perth.

6.—Aberfoyle, Balquhidder, Blackford, Callander, Dunblane, Kilmadock, Kincardine, and Port of Monteith. *Enumerator*, Robert Patterson, Offers, Stirling.

7.—Dull, Fortingall, Kenmore, Killin, Logierait, and Weem. *Enumerator*, F. N. Menzies, Tirinie, Aberfeldy.

8.—Blair-Athole, Dunkeld, Little Dunkeld, and Moulin. *Enumerator*, Alexander Conacher, Mains of Pitlochrie, Pitlochrie.

9.—Aylth, Bendochy, Blairgowrie, Cluny, Coupar-Angus, Kinloch, Kirkmichael, Meigle, and Rattray. *Enumerator*, Robert Geekie, Rosemount, Blairgowrie.

26.—COUNTY OF RENFREW.

District No. 1.—Cathcart, Eaglesham, Mearns, and Neilston. *Enumerator*, Arthur Mather, Netherplace, Newton Mearns.

2.—Eastwood, Paisley and Abbey, and Renfrew. *Enumerator*, John Colquhoun, Corkerhill, Pollockshaws.

3.—Erskine, Houston, Inchinnan, Kilbarchan, and Lochwinnoch. *Enumerator*, Alexander Wilson, Forehouse, Kilbarchan.

4.—Greenock, Innerkip, Kilmacolm, and Port-Glasgow. *Enumerator*, James Foster King, Wester Longhaugh, Bishopton.

27.—COUNTY OF ROSS AND CROMARTY.

District No. 1.—(Easter Ross.) Edderton, Fearn, Kilmuir, Kincardine, Logie Easter, Nigg, Rosskeen, Tain, and Tarbert. *Enumerator*, Crawford Ross, Cadboll, Tain.

2.—(Wester Ross.) Alness, Avoch, Contin, Cromarty, Dingwall, Fodderty, Killearnan, Kiltearn, Knockbain, Resolis, Rosemarkie, Urquhart, and Urray. *Enumerator*, William Murray, Kilcoy, Dingwall.

3.—Gairloch. *Enumerator*, Charles Robertson, Auchtercairn, Lochalsh.

4.—Lochbroom. *Enumerator*, David Mundell, Auchendrean, Lochbroom.

5.—Applecross, Glenshiel, Kintail, Lochalsh, and Lochcarron. *Enumerator*, David Logan, Auchtertyre, Lochalsh.

6.—(Lewes.) Barvas, Lochs, Stornoway, and Uig. *Enumerator*, Murdoch M'Aulay, Lynshader, Stornoway.

28.—County of Roxburgh.

District No. 1.—Ednam, Kelso, Smailholm, Sprouston, and Stitchell. *Enumerator*, John Dudgeon, Spylaw, Kelso.

2.—Hownam, Linton, Morebattle, and Yetholm. *Enumerator*, Adam B. Boyd of Cherrytrees, Kelso.

3.—Crailing, Eckford, Makerstown, and Roxburgh. *Enumerator*, James Roberton, Ladyrig, Kelso.

4.—Bedrule, Hobkirk, Jedburgh, Oxnam, and Southdean. *Enumerator*, John Ord of Muirhouselaw, Nisbet, Kelso.

5.—Ancrum, Bowden, Lilliesleaf, Maxton, Melrose, Minto, and St Boswells. *Enumerator*, Nicol Milne of Faldonside, Melrose.

6.—Ashkirk, Cavers, Hawick, Kirkton, Roberton, and Wilton. *Enumerator*, Daniel Mather, Hallrule, Bonchester Bridge.

7.—Castleton. *Enumerator*, John Jardine, Arkleton, Langholm.

29.—County of Selkirk.

Ettrick, Galashiels, Kirkhope, Selkirk, and Yarrow. *Enumerator*, John Anderson, Muirhouse, Stow.

30.—County of Stirling.

District No. 1.—Airth, Alva, Bothkennar, Denny, Dunipace, Falkirk, Gargunnock, Larbert, Lecropt, Muiravonside, Polmont, St Ninians, Slamannan, and Stirling. *Enumerator*, William Forrester, Stewarthall, Stirling.

2.—Baldernock, Balfron, Buchanan, Campsie, Drymen, Fintry, Killearn, Kilsyth, Kippen, and Strathblane. *Enumerator*, James Horne, New Mills, Campsie.

31.—County of Sutherland.

District No. 1.—Farr, Tongue, Easter portion of Durness and Reay (in Sutherland.) *Enumerator*, Alexander Clarke, Eriboll, Tongue.

2.—Assynt, Edderachillis, and Western portion of Durness. *Enumerator*, Evander M'Iver, Scourie.

3.—Dornoch, Creich, Lairg, and Rogart. *Enumerator*, Robert B. Sangster, Golspie.

4.—Clyne, Golspie, Kildonan, and Loth. *Enumerator*, Charles Hood, Inverbrora, Golspie.

32.—County of Wigtown.

District No. 1.—(Machars.) Glasserton, Kirkinner, Kirkcowan, Mochrum, Penninghame, Sorby, Whithorn, and Wigtown. *Enumerator*, James Caird, Baldoon, Wigtown.

2.—(Rhins.) Inch, Kirkcolm, Kirkmaiden, Leswalt, Old Luce, New Luce, Portpatrick, and Stoneykirk. *Enumerator*, John Crawford, Glenhead, Stranraer.

AGRICULTURAL STATISTICS OF SCOTLAND, 1855.

SUPPLEMENTARY REPORT.

HIGHLAND AND AGRICULTURAL SOCIETY,
EDINBURGH, *January* 23, 1856.

SIR,—In the Report transmitted on the 11th of December to the Lords of Committee of Privy Council for Trade, with the Scotch Statistical Tables, I stated that returns had been called for regarding the Weight and Quality of the Grain Crops in different districts. Answers having been received, with few exceptions, from the enumerators, I have now the honour of forwarding the information thus obtained.

If my Lords consider such returns as of any importance, and desire that they should in future be made a branch of the Statistical Inquiry, I would propose applying for them, not by means of a general circular, such as was issued to enumerators in 1855, but by a Schedule categorically arranged for the purpose, in the hope of obtaining reports of a more precise and systematic character than those now forwarded.

I have the honour to be,
SIR,
Your most obedient servant,
(Signed) J^N^. HALL MAXWELL.

JAMES BOOTH, Esq.,
Principal Secretary of the Board of Trade.

RETURNS OF THE AVERAGE WEIGHT OF GRAIN PER BUSHEL IN EACH DISTRICT.

COUNTIES.	Crops reported on.	Weight per Bushel.	GENERAL OBSERVATIONS.
ABERDEEN.		Lbs.	
District 1,	Wheat, . .	——	Deficient, though superior to barley and oats.
	Barley and bere,	50 to 53	2 to 3 lb. lighter than crop 1854.
	Oats, . .	36 to 42	
District 2,	Barley, . .	54	Generally good.
	Oats, . .	40	
District 3,	Wheat, . .	——	Quality and weight deficient.
	Barley and bere,	51½	Fully 2 lb. lighter than in 1854.
	Oats, . .	40	
	Beans and pease,	——	Under average weight.
District 4,	Wheat, . .	61	2 lb. lighter than in 1854.
	Barley and bere,	52	
	Oats, . .	40	

Returns of the Average Weight of Grain per Bushel—*Continued.*

Counties.	Crops reported on.	Weight per Bushel.	General Observations.
Aberdeen—*cont.*		Lbs.	
District 5,	Wheat, . .	59	——
	Barley, . .	52	
	Bere, . .	51	
	Oats, . .	40 to 41	
Argyll.			
District 1,	Wheat, . .	64	Quality good.
	Barley and bere,	50	
	Oats, . .	39	
	Beans and pease,	50	
District 2,	Barley, . .	52	Quality pretty good.
	Bere, . .	48	
	Oats, . .	40	
District 3,	Barley, . .	52	Inferior to crop 1854 both in quality and quantity.
	Bere, . .	50	
	Oats, . .	40	
	Beans, . .	64	——
District 4,	Wheat, . .	60	Quality good.
	Barley and bere,	50	
	Oats, . .	37	
	Beans, . .	60	
District 5,	——	——	No report.
District 6,	Barley, . .	53	Average.
	Bere, . .	49	
	Oats, . .	40	
Districts 7 & 8,	——	——	No report.
District 9,	Bere, . .	51½	In good condition.
	Oats, . .	37½	
District 10,	——	——	No report.
Ayr.			
District 1,	Wheat, . .	61	——
	Barley, . .	52	——
	Oats, . .	35	Deficient in weight.
	Bere, . .	48	——
	Beans and pease,	65	——
District 2,	Wheat, . .	60	1 lb. below average.
	Barley, . .	54	Full average.
	Oats, Long,	34	2 to 2½ lb. below average.
	Oats, Short,	39	
	Beans, . .	64	Average.
District 3,	Wheat, . .	59	Quality variable, but more light grain than usual.
	Barley, . .	50	
	Bere, . .	48	
	Oats, . .	34	
	Rye, . .	57	
	Beans, . .	62	
District 4,	Wheat, . .	58½ to 61	——
	Oats, . .	33½ to 34	
Banff.			
District 1,	Wheat, . .	——	2 to 3 lb. lighter than 1854.
	Barley, . .	——	
	Oats, . .	——	

Returns of the Average Weight of Grain per Bushel—*Continued.*

Counties.	Crops reported on.	Weight per Bushel.	General Observations.
BANFF—*continued.*		Lbs.	
District 2,	Wheat, . .	61	Below average in weight, but in good condition.
	Barley, . .	52½	
	Bere, . .	51	
	Oats, . .	40	
BERWICK. District 1,	Wheat, . .	61	Average.
	Barley, . .	52	Inferior.
	Oats, . .	41	———
District 2,	Wheat, . .	60	All inferior.
	Barley, . .	52	
	Oats, . .	40	
BUTE & ARRAN. District 1,	Wheat, . .	61	Average.
	Barley, . .	53½	
	Oats, . .	38	1 lb. below average.
District 2,	Wheat, . .	60	——— (Crops, though not equal to 1854, above an average.)
	Barley, . .	52	Good quality.
	Bere, . .	50	Ditto.
	Oats, . .	30 to 42	Varied too much to admit of an average.
	Beans, . .	61	———
CAITHNESS. District 1,	Wheat, . .	60	2 lb. below average.
	Barley, . .	48 to 50	3 lb. below average.
	Bere, . .	48 to 49	3 lb. below average.
	Oats, . .	36 to 41	2 lb. below average
District 2,	Wheat, . .	58	Average quality, but proportion of light grain large.
	Bere, . .	49	
	Oats, . .	39	
CLACKMANNAN.	Wheat, . .	61	Good quality.
	Barley, . .	52	
	Oats, . .	39	
	Beans, . .	64½	
DUMBARTON.	Wheat, . .	60	Unusual proportion of light grain, from crops being lodged.
	Barley, . .	50 to 52	
	Oats, . .	38 to 40	
	Beans, . .	50 to 52	
DUMFRIES. District 1,	Wheat, . .	62	Generally below average weight, but in good condition.
	Barley, . .	53	
	Bere, . .	50	
	Oats, . .	39	
	Beans, . .	62	
District 2,	Wheat, . .	60	About 1 lb. below average.
	Barley, . .	51½	Average weight; quality rather coarse.
	Oats, . .	38¾	2½ to 3 lb. below average.
	Rye, . .	53	———
	Beans, . .	64	Quality good.

Returns of the Average Weight of Grain per Bushel—*Continued.*

Counties.	Crops reported on.	Weight per Bushel.	General Observations.
Dumfries—*cont.*		Lbs.	
District 3,	Wheat, . .	60	Average, except oats, which are deficient.
	Barley, . .	51	
	Bere, . .	49	
	Oats, . .	38	
	Beans and pease,	58	
District 4,	Wheat, . .	60	Generally inferior, particularly oats.
	Barley, . .	52	
	Oats, . .	39	
	Beans, . .	63	
District 5,	Wheat, . .	58	3 lb. below average.
	Barley, . .	51	2 lb. below average.
	Oats, . .	39	
Edinburgh.			
District 1,	Wheat, . .	61	Wheat and beans, average; barley and oats, below average.
	Barley, . .	53	
	Oats, . .	40½	
	Beans, . .	62	
District 2,	Wheat, . .	61	Generally below average.
	Barley, . .	52½	
	Oats, . .	40	
	Beans, . .	63	
District 3,	——	——	Crops generally 1 to 2 lb. lighter than 1854.
Elgin.	Wheat, . .	63	Average.
	Barley, . .	55	
	Oats, . .	41	Above average.
Fife.			
District 1,	Wheat, . .	60 to 64	Average.
	Barley, . .	50 to 57	
	Oats, . .	36 to 45	
	Beans, . .	60 to 66	
District 2,	Wheat, . .	61	A fair average, though inferior to 1854.
	Barley, . .	52	
	Oats, . .	40 to 41	1 lb. below average.
District 3,	Wheat, . .	61 to 62	Fair average, though inferior to 1854.
	Barley, . .	52	
	Oats, . .	40	Below average.
	Beans and pease,	62 to 63	——
District 4,	Wheat, . .	60	Generally 1 to 2 lb. below average.
	Barley, . .	52	
	Oats, . .	40	
	Rye, . .	54	
	Beans and pease,	62	
Forfar.			
District 1,	Wheat, . .	60 to 62	——
	Barley, . .	52	
	Oats, . .	40	
District 2,	Wheat, . .	62½	1½ lb. inferior to 1854. All below average weight.
	Barley, . .	52½	2½ lb. inferior to 1854.
	Oats, .	40½	1½ lb. inferior to 1854.

Returns of the Average Weight of Grain per Bushel—*Continued.*

Counties.	Crops reported on.	Weight per Bushel.	General Observations.
Haddington.		Lbs.	
District 1,	———	——	Cereals about 1½ lb. below an average, and proportion of light grain great.
District 2,	———	——	No report.
District 3,	———	——	Wheat, barley, and oats, 2 lb. below average. Beans an average.
District 4,	Wheat, . .	62½	———
	Barley, . .	53	
	Oats, . .	42½	
	Beans, . .	65	
District 5.	Wheat, . .	61 to 62	Inferior, with a large proportion of light grain.
	Barley, . .	53 to 54	
	Oats, . .	41	
District 6,	———	——	No report.
Inverness.			
District 1,	———	——	Wheat and barley good quality and average weight. Oats below average weight.
District 2,	Wheat, . .	61½	———
	Barley, . .	53¾	
	Oats, . .	41	
District 3,	Wheat, . .	62	———
	Barley, . .	54 to 55	
	Oats, . .	41	
District 4,	Oats, . .	39½	Below an average.
	Bere, . .	50	
District 5,	Oats, . .	42	———
District 6,	Oats, . .	38	———
Districts 7, 8, 9, 10, 11,	———	——	No reports.
Kincardine.	Wheat, . .	61¼	Below an average, and considerably below 1854.
	Barley, . .	52	
	Oats, . .	39½	
	Rye, . .	55½	
	Bere, . .	50½	
	Beans, . .	60¾	
Kinross.	Wheat, . .	58	———
	Barley, . .	52	
	Oats, . .	40	
Kirkcudbright.			
District 1,	Wheat, . .	60	2 lb. below 1854.
	Barley, . .	51	1½ lb. below 1854.
	Oats, . .	38	2 lb. below 1854.
District 2,	Wheat, . .	60	1 lb. below average.
	Barley, . .	52	Barely an average.
	Oats, . .	40	1 to 2 lb. below average.

Returns of the Average Weight of Grain per Bushel—*Continued.*

Counties.	Crops reported on.	Weight per Bushel.	General Observations.
Kirkcudbright.—*Continued.*		Lbs.	
District 3,	Wheat, . .	60	——
	Barley, . .	53	
	Oats, . .	39	
District 4,	Barley, . .	50	Generally good.
	Oats, . .	40	
Lanark.			
District 1,	Wheat, . .	59	About 2½ lb. below 1854.
	Barley, . .	53	
	Oats, . .	37	
	Beans, . .	——	Fully an average.
District 2,	Wheat, . .	59	Coarse. Generally more deficient in weight than quantity.
	Barley, . .	50	Large proportion of light grain.
	Bere, . .	48	An average.
	Oats, . .	38	Very deficient in weight.
Linlithgow.	Wheat, . .	61	Full average.
	Barley, . .	52½	Average.
	Oats, . .	40	
	Beans, . .	64	Full average.
Nairn.	Wheat, . .	63	Generally good; oats, though light, mealing well.
	Barley, . .	55	
	Oats, . .	41	
Orkney.	Bere, . .	46	Quality and weight below 1854.
	Oats, . .	38½	
Peebles.	Wheat, . .	60	Quality much inferior to 1854, with more light grain.
	Barley, . .	52½	
	Oats, . .	40	
Perth.			
District 1,	Wheat, . .	61¾	Generally inferior to 1854, especially oats.
	Barley, . .	52	
	Oats, . .	40	
	Beans and pease,	63½	
District 2,	Wheat, . .	61½	Average.
	Barley, . .	52½	2 to 2½ lb. below average.
	Oats, . .	40	1½ lb. below average
District 3,	Wheat, . .	61	Average.
	Barley, . .	51	Below average.
	Oats, . .	39	
District 4,	Wheat,	58 or 59 to 63 or 64	——
	Barley, . .	48 to 53	
	Oats, . .	37 to 41	
	Beans and pease,	60 to 63	
District 5,	Wheat, . .	61	Good.
	Barley, . .	51	Good.
	Oats, . .	39½ to 40	Good, but light.

Returns of the Average Weight of Grain per Bushel—*Continued.*

COUNTIES.	Crops reported on.	Weight per Bushel.	GENERAL OBSERVATIONS.
PERTH—*continued.*		Lbs.	
District 6,	——	——	No report.
District 7,	Wheat,	61	Average quality, but inferior to 1854.
	Barley,	52½	
	Oats,	39	
	Rye,	58	
	Bere,	47½	
	Beans and pease,	60	
District 8,	Wheat,	62½	Average.
	Barley,	52½	
	Oats,	40	
	Bere,	50	
District 9,	Wheat,	61	1 lb. below 1854.
	Barley,	52	3 lb. below 854.
	Oats,	40	
RENFREW.			
District 1,	Wheat,	56 to 60	Belowa verage.
	Barley,	——	1 to 2 lb. above average.
	Oats,	——	1 to 2 lb. below average.
District 2,	Wheat,	58	2 lb. below 1854.
	Barley,	——	Equal to 1854.
	Oats, Short,	40	2½ lb. below 1854.
	Oats, Long,	34	3½ lb. below 1854.
	Beans,	——	3 lb. below 1854.
District 3,	——	——	Crop generally deficient—more so in quality than quantity.
District 4,	Oats,	36	Quality inferior—other cereals an average, but little grown.
ROSS & CROMARTY.			
District 1,	Wheat,	62	Average.
	Barley,	54	
	Oats,	41	Under average.
	Beans and pease,	63 to 66	——
District 2,	Wheat,	61	Above average.
	Barley,	54	Full average.
	Oats,	40	Deficient in weight.
District 3,	——	——	No report.
District 4,	Oats,	39	Below average.
District 5,	——	——	No report.
District 6,	Oats,	37	Below average weights
	Bere,	48	
ROXBURGH.			
District 1,	Wheat,	61	Rather under average.
	Barley,	51½	6 per cent under average.
	Oats,	40	4 per cent under average, and much light grain.
	Beans and pease,	63	Average.
District 2,	Wheat,	60	Nearly average.
	Barley,	52	6 per cent below average.
	Oats,	39	4 per cent below average.

Returns of the Average Weight of Grain per Bushel—*Continued.*

Counties.	Crops reported on.	Weight per Bushel.	General Observations.
Roxburgh—*cont.*		Lbs.	
District 3,	Wheat, . .	60	1½ lb. below average.
	Barley, . .	53	2 lb. below average.
	Oats, . .	40	1 lb. below average.
	Beans and pease,	64½	1½ lb. below average.
District 4,	Wheat, . .	60¾	——
	Barley, . .	51¼	
	Oats, . .	39¾	
	Beans and pease,	63	
District 5,	Wheat, . .	61½	Generally below average, particularly barley.
	Barley, . .	52	
	Oats, . .	40½	
	Beans, . .	63	
	Pease . .	61½	
District 6,	Wheat, . .	61	Average.
	Barley, . .	53	
	Oats, . .	39	
District 7,	Barley, . .	49	Good, but deficient in weight.
	Oats, . .	38½	
Selkirk.	Wheat, . .	61½	General quality inferior to 1854.
	Barley, . .	52	
	Oats, . .	40½	
	Pease, . .	59	
Stirling.			
District 1,	Wheat, . .	——	1½ lb. below 1854.
	Barley, . .	——	3 lb. below 1854.
	Oats, . .	——	2 lb. below 1854.
	Beans, . .	——	3 lb. below 1854.
District 2,	——	——	No report.
Sutherland.			
District 1,	Oats, . .	40	Under average weight.
	Bere, . .	50	
District 2,	Barley, . .	53	——
	Oats, . .	36	
	Bere, . .	47	
District 3,	——	——	No report.
District 4,	Wheat, . .	60	Good, but weight below 1853 and 1854.
	Barley, . .	54 to 55	
	Oats, . .	41 to 42	
Wigtown.			
District 1,	Wheat, . .	60	A full average both in quantity and quality.
	Barley, . .	53	
	Oats, . .	40	
	Beans, . .	66	
District 2,	Wheat, . .	61	Barley and bere about average weight; quality generally good, except oats on light soils.
	Oats, . .	38	
	Rye, . .	55	
	Beans, . .	65	

TABLE SHOWING THE WEIGHTS OF TURNIPS ON VARIOUS FARMS IN THE MIDDLE AND UPPER DISTRICTS OF ANNANDALE.

Inspected between the 5th and 15th November 1855.

[THE Society having for several years published the Reports, by the Lockerbie Farmers' Club, of the turnip crops in Annandale, the results of the inspection for 1855 are inserted again as containing valuable information at this season, and as a record for after reference and comparison.]

NAMES OF FARMS, PARISHES, AND KINDS OF TURNIPS.	No. of Acres Scotch.	Width of Drill in inches.	No. of Turnips on 10 lineal yards.	WEIGHT. Per Scotch Acre.	WEIGHT. Per Imperial Acre.	MANURE PER SCOTCH ACRE. Farmyard Dung.	Peruvian Guano.	Dissolved Bones.	Other Manures.	DATE OF SOWING.
				tons cwt.	tons cwt.	yards	cwt.	cwt.		
HARDGRAVE, *Dalton*,										
Sk.'s Purple Top Swede, .	8¼	27	29	44 7	35 2	17½	3¾	0⅝		21 and 22 May
Do. do. .	20¼	27	29	37 9	29 13	16¼	3¾	0⅝		22 to 25 May
Sk.'s Purple Top Yellow, .	4¼	27	28	26 10	21 0	15	3	0⅝		9 June
Sk.'s Hardy Green, . . .	14¼	27	28	35 12	28 4	15	3	0⅝		6 to 8 June
Sk.'s White Globe, . . .	20½	27	26	33 16	26 15	15	3	0⅝		10 to 14 June
GREENHILLHEAD, *Lochmaben*,										
Purple Top Swede, . . .	10	27	31	29 16	23 12	25	3			20 May
HIGHLAW, *St Mungo*,										
Purple Top Swede, . . .	18	27	32	22 18	18 3	14	2			24 to 26 May
Pomeranian White, . . .	2	27	33	23 19	19 0	10	2½			12 June
DIXONS, *Tundergarth*,									[of lime	
Sk.'s Purple Top Swede, .	4	27	37	43 12	34 11	20	2	2	1¼ cwt. superph.	18 and 19 May
HILLSIDE, *Dryfesdale*,										
Sk.'s Purple Top Swede, .	3½	27	32	28 14	22 15	25	2	3½		15 to 23 May
Purple Top Yellow, . . .	0¼	27	36	30 10	24 4	22½	1½	3		11 June
Green Top Yellow, . . .	2¼	27	33	25 1	19 17	22½	1½	3		9 to 11 June
BYRESTEADS, *Dryfesdale*,										
Yellow Bullock, ...	1	28	30	25 18	20 11	25	2½	1		6 June
Purple Top Yellow, . . .	2	28	32	29 8	23 6	32	2	2		30 May
DRYFESDALE MANSE, *Dryfesdale*,										
Sk.'s Purple Top Swede, .	2	29	33	24 6	19 6	20	3	1½		
Hardy Green, ...	0¾	29	33	23 13	18 13	16	3	1½		
Pomeranian White, . . .	2½	27	36	30 18	24 9	16	3	1½		
UNDERWOOD, *Dryfesdale*,										
Purple Top Swede, . . .	3	27	32	32 7	25 12	15	1	1	2 cwt. bone meal	24 May
Hardy Green, ...	2	27½	29	46 0	36 9	15	1	1	do. do.	7 June
Purple Top Yellow, . . .	2	28	30	38 3	30 5	12	1	0½	do. do.	7 June
ROSEBANK, *Dryfesdale*,										
Purple Top Swede, . . .	4	27	34	26 10	21 0	16	2	2		25 and 26 May
Pomeranian White, . . .	6	28	33	29 8	23 6	16	2	2		2 to 22 June
BENGALL, *Dryfesdale*,										
Sk.'s Purple Top Swede, .	24	27	37	39 19	31 15	20	3			15 to 22 May
KIRKBURN, *Dryfesdale*,										
Purple Top Swede, . . .	3	28	34	30 2	28 17	30	2		15 bush. bones	5 May
Yellow Bullock, ...	1	28	41	44 9	35 5	18	2		10 do. do.	12 May
Hardy Green, ...	3	28	37	33 12	26 13	25	2		12 do. do.	21 May
LAMMONBIE, *Applegarth*,										
Skirving's Swede, . . .	7	28	36	32 11	25 16	25	2			19 to 22 May
Yellow Bullock, ...	7	28	36	22 1	17 10	18	1¾			11 to 13 June
Do. do.	7	28	40	22 1	17 10		4			14 to 19 June
Forsdale's Hybrid, . . .	0¾	28	44	26 12	21 2		4			13 June
White Globe, ...	2½	28	42	30 16	24 8		4			9 June
BALGRAY, *Applegarth*,										
Sk.'s Purple Top Swede, .	4	28	36	26 5	20 16	25	2		20 bush. bones	21 to 31 May
Green Top Yellow, . . .	7	28	36	24 17	19 14	25	2			1 to 12 June
Yellow Bullock, ...	10	27	38	23 5	18 8	20	3		12 bush. bones	25 June
Red Top White, ...	3½	27	33	20 14	16 8		2		20 do. do.	7 to 14 July
Pomeranian White, . . .	4½	27	30	25 9	20 3		2		20 do. do.	20 July
MUIRHOUSEFOOT, *Applegarth*,										
Sk.'s Purple Top Swede, .	} 12	28	40	32 11	25 16	15	4			20 to 25 May
Do. do. .		28	38	32 11	25 16	15	4			Do.
Aberdeen Yellow, . . .	7	28	40	30 9	24 3	15	3½			28 May

[Table continued.

Names of Farms, Parishes, and Kinds of Turnips.	No. of Acres Scotch.	Width of Drill in inches.	No. of Turnips on 10 lineal yards.	Weight.		Manure per Scotch Acre.				Date of Sowing.
				Per Scotch Acre.	Per Imperial Acre.	Farmyard Dung.	Peruvian Guano.	Dissolved Bones.	Other Manures.	
				tons cwt.	tons cwt.	yards	cwt.	cwt.		
Millbank, *Applegarth,* . .										
Sk.'s Purple Top Swede, :	3	28	41	31 10	25 0	20	3			21 and 22 May
Green Top Swede, . . .	3	28	43	27 6	21 13	20	3			Do.
Yellow Bullock, ...	4	28	43	28 0	22 4	15	2½			7 June
Do. do. . . .	5	28	36	17 10	13 17		3	2		12 June
Sk.'s Purple Top Swede, .	3	28½	34	33 14	26 14	20	3			19 May
Brieryhill, *Applegarth,* .										
Sk.'s Purple Top Swede, .	8	29	29	27 14	22 0	25	2			20 to 25 May
Yellow Bullock, ...	14	27	30	26 18	21 6	20	2			15 to 20 June
Pomeranian White, . . .	2	28	36	42 7	33 11	20	2			Do.
Blindhillbush, *Applegarth,*										
Yellow Bullock, ...	7	27	29	20 14	16 8	15	2	2		13 to 16 June
Purple Top Yellow, . . .	4	27	28	21 9	17 0	15	2	2		Do.
Gillenbie, *Applegarth,*										
Green Top Swede, . . .	6	28	31	25 4	20 0	12	2	2½	7 bush. bones	18 to 24 May
Hardy Green, ...	2	28	32	28 14	22 15	12	2	2½	do. do.	17 to 23 June
Yellow Bullock, ...	7	28	34	27 13	22 18	12	2	2½	do. do.	10 to 17 June
Pomeranian White, . . .	2	28	35	33 12	26 13	12	2	2½	do. do.	Do.
Dalmakeddar, *Applegarth,*										
Sk.'s Purple Top Swede, .	4	26½	36	27 7	21 14	25	2			22 to 31 May
Laing's Swede, ...	1	28	37	26 12	21 2	25	2			Do.
Purple Top Swede, . . .	4	27	40	18 3	14 8	25	2			Do.
Yellow Bullock, ...	10	29	34	17 4	13 13	25	2			11 to 23 June
Pomeranian White, . . .	10	28	37	32 4	25 11	25	2			4 to 9 June
Dinwoodie Mains, *Applegarth,*										
Sk.'s Purple Top Swede, .	11	28	37	29 15	23 12	12	2			17 May
Do. Yellow, .	5	28½	43	27 17	22 2	12	2			23 to 26 May
Do. Swede, .	7	28	31	33 5	26 7	15	2			15 to 18 May
Pomeranian White, . . .	12	27½	42	26 0	20 12	10	2			10 June
Green Top Yellow, . . .	7	28	37	23 9	18 12		4			24 to 30 June
Barnsdale, *Hutton,*										
Pomeranian White, . . .	1	27½	25	27 2	21 9	15	2	2		9 June
Sk.'s Purple Top Yellow, .	1	27½	25	23 18	18 18	15	2	2		Do.
Hardy Green, ...	2	27½	32	39 18	31 13	15	2	2		Do.
Sk.'s Purple Top Swede, .	12	28	29	28 0	22 4	20	2½	3		13 to 17 May
Shaw, *Hutton,*										
Hardy Green, ...	1½	27½	27	37 16	29 19	15	2	2		7 June
Yellow Bullock, ...	2	27½	27	25 6	20 1	15	2	2		Do.
Hardy Green, ...	2	27½	28	31 14	25 3	15	2	2		Do.
Pomeranian White, . . .	1½	27½	27	32 16	26 0	15	2	2		Do.
Millriggs, *Hutton,*										
Purple Top Yellow, . . .	2	28	31	22 15	18 1		3	3		23 June
Pomeranian White, . . .	2	28	30	40 5	31 18		3	3		Do.
Yellow Bullock, ...	2	28	31	17 3	13 12		3	3		Do.
Hutton, *Hutton,*										
Purple Top Yellow, . . .	3	26½	38	18 17	14 19	12	2	2		2 June
Yellow Bullock, ...	2	26½	30	20 15	16 8		2½	2½		5 June
Boreland, *Hutton,*										
Purple Top Yellow, . . .	2	27½	33	30 6	24 0	15	2			3 June
Do. Swede, . . .	4½	28	35	38 10	30 10	30	2			25 May
Green Top Yellow, . . .	1½	27½	49	26 8	20 18	15	2			3 June
Dalfibble, *Kirkmichael,*										
Pomeranian White, . . .	5½	27	33	53 16	42 12	16	2		7 bush. bones	21 May
Laing's Purple Top Swede,	20	27½	34	36 7	28 16	16	3		do. do.	21 to 28 May
Forsdale's Hybrid, . . .	5½	27½	40	39 18	31 13	18	2			Do.
Gamerigg, *Kirkmichael,*										
Yellow Bullock, ...	4	27½	36	28 10	22 12	16	3			1 to 7 June
Pomeranian White, . . .	10	27½	37	39 11	31 7	16	3			Do.
Laurie's Swede, ...	14	27½	36	28 3	22 6	16	3			1 to 12 June
Pomeranian White, . . .	8	27½	36	29 19	23 15	12	2½			Do.
Annanbank, *Johnstone,*										
Pomeranian White, . . .	1	28	32	33 5	26 7	15	2			22 June
Yellow Bullock, ...	5	28	28	27 6	21 13	15	2			4 June
Do. do.	2	28	29	26 19	21 7	15	2			End of May
Sk.'s Purple Top Swede, .	5	28½	29	33 7	26 9	18	2			17 to 21 May
Do. do. . .	5	29	30	33 2	26 6	18	2			Do.
Sk.'s Purple Top Yellow, .	2	29	34	31 15	25 4	15	2			8 June
Yellow Bullock, ...	2	29	28	22 6	17 14	15	2			Do.

[*Table continued.*

Names of Farms, Parishes, and Kinds of Turnips.	No. of Acres Scotch.	Width of Drill in inches.	No. of Turnips on 10 lineal yards.	Weight. Per Scotch Acre.	Weight. Per Imperial Acre.	Manure per Scotch Acre. Farmyard Dung.	Peruvian Guano.	Dissolved Bones.	Other Manures.	Date of Sowing.
				tons cwt.	tons cwt.	yards	cwt.	cwt.		
Mains, *Johnstone*,										
Pomeranian White, . . .	4	26	32	27 18	22 3	15	2¾			15 July
Do. do. . . .	4	27	43	19 12	15 10		3½			20 July
Scorisbrick, ...	5	27½	37	34 5	27 2	18	2¾			24 to 25 May
Yellow Bullock, ...	2½	27½	31	26 0	20 12	18	2¾			Do.
Purple Top Yellow, . . .	4	27	28	29 8	23 6	20	2¾			18 June
Yellow Bullock, ...	4	27	39	30 3	23 18	20	2¾			20 June
Broomhills, *Wamphray*,										
Pomeranian White, . . .	4	27	32	32 14	25 18	18	3			22 June
Do. do. . . .	2	26½	32	28 2	22 6	18	3			12 June
Sk.'s Purple Top Yellow, .	1	27	38	21 16	17 5	18	3			5 June
Aberdeen Yellow, . . .	8	28	40	27 6	21 13	18	3			2 June
Killbrook, *Wamphray*, . .										
Scorisbrick, ...	0¾	27	41	26 10	21 0		3			7 to 14 June
Yellow Bullock, ...	1½	27	32	24 7	19 6	10	2½			Do.
Do. do.	7	27½	32	23 11	18 13	10	2½			Do.
Hardy Green, ...	2	27	31	33 16	26 15	10	2½			10 June
Wamphraygate, *Wamphray*,										
Sk.'s Purple Top Swede, .	3	28½	38	27 4	21 11	25	3			26 May
Yellow Bullock, ...	5	27	36	27 5	21 12	20	2½			7 June
Dale's Hybrid, ...	1	27	35	30 18	24 9	20	2			14 June
Yellow Bullock, ...	5	27	34	26 18	21 6	20	2			Do.
Do. do.	5	28	36	26 5	20 16	26				1 to 14 June
Pomeranian White, . . .	4½	29	35	26 0	20 13	18	2			7 to 14 July
Kirkhill, *Wamphray*,										
Sk.'s Purple Top Swede, .	3	28½	31	28 18	22 18	25	2			19 June
Gibb's Orange Yellow, . .	3	28	33	20 6	16 2	20	2			23 to 25 June
Aberdeen Yellow, . . .	1	28	31	22 1	17 10	25	1		17 bush. bones	23 to 27 June
Hardy Green, ...	2	27	32	22 18	18 3	25				23 to 25 June
Pomeranian White, . . .	2¾	27	28	24 7	19 6	25				23 to 27 June
Purple Top Yellow, . . .	0½	28	32	22 15	18 1	20	2			19 June
Marchbankwood, *Kirkpatrick-Juxta*,										
Sk.'s Purple Top Swede, .	2	29	37	32 15	26 0	20	1¾	1¾	1¾ bush. grd. bones	15 May
Ashcroft's do. .	2	27	40	31 12	25 1	15	1¾	1¾	do. do.	16 May
Tankard do. .	1	27	35	31 19	25 6	15	1¾	1¾	do. do.	17 May
Laing's do. .	1	27	38	27 12	21 17	15	1¾	1¾	do. do.	18 May
Sutton's Stubble do. .	3	27	35	33 16	26 15	15	1¾	1¾	do. do.	Do.
Sutton's Purple Top do. .	2	27	41	31 12	25 1	15	1¾	1¾	do. do.	16 May
Milton, *Kirkpatrick-Juxta*,										
Pomeranian White, . . .	15	27	32	41 16	33 2	16	2½			21 to 26 June
Purple Top Yellow, . . .	6	27	40	27 12	21 17	18	2½			12 to 19 June
Sk.'s Purple Top Swede, .	5	28	40	30 9	24 3	18	2½			20 May
Pomeranian White, . . .	4	27	35	40 14	32 5	18	2½			26 June

AVERAGE WEIGHT FOR CROP 1855.

	Scotch. tons cwt.	Imperial. tons cwt.
Swedes, ...	30 14	24 7
Yellow, ...	26 6	20 17
Common, ...	32 5	25 12

AVERAGE WEIGHT OF EACH OF THE LAST SEVEN CROPS,

PER IMPERIAL ACRE.

	1849. tons cwt.	1850. tons cwt.	1851. tons cwt.	1852. tons cwt.	1853. tons cwt.	1854. tons cwt.	1855. tons cwt.
Swedes,	21 16	24 9	19 16	23 7	21 19	20 8	24 7
Yellow,	20 10	19 14	17 0	17 7	23 4	18 13	20 17
Common,	22 7	25 14	21 1	33 14	27 3	22 0	25 12

LOCKERBIE, *November* 22, 1855.

Mr John Halliday, having been appointed to weigh the turnip crop, gave in the report of the weights on thirty farms, all held by members of the Lockerbie Club, and also a note of the remarks that had occurred to him in the course of his inspection, which had been made between the 1st and 12th November.

The Club were satisfied that Mr Halliday had taken the weights with great accuracy, and various members stated that they had tested and confirmed by weighing in bulk some for sale and otherwise.

The following Report contains Mr Halliday's remarks, and results of the discussion of the Club.

GENERAL DESCRIPTION OF THE SEASON, AND ITS EFFECTS ON THE TURNIP CROP.

The weather in May and the early part of June, though cold, was dry, and exceedingly favourable for cleaning the land; but not being devoid of moisture, and unaccompanied by frosty nights, allowed the seed to braird in a healthy manner. After the 20th of June there was a good deal of rain, and the remainder of the month and all July was most favourable, the temperature being very high (average 60°), and with a suitable quantity of rain. At the end of the month, turnips were far forward and very thriving. August set in with so much rain that they were a little checked on some situations; but the large quantity that then fell in this district kept a degree of moisture in the soil that served to counteract, in a great measure, the effects of the long tract of dry weather that followed till near the end of September, though they were, on some warm gravel soils in the lower and driest part of the district, retarded temporarily by drought. The plentiful rain in the month of October, with a moderate temperature, again revived the growth; and thus, at the beginning of November, we had a large crop. Where there is abundance of manure, and especially on strong soils, the weight evidently continues to increase.

Though we have on the whole of the five months the same large quantity of rain as in 1854, it did not, as in that year, interfere with the time of sowing; and still more, the higher temperature (4°) of July 1855, compared with July 1854, made the rains of this year produce a luxuriant growth, while in last year they chilled the ground and checked it. And it has been our large falls of rains in August that carried us through the drought of September better than those on the east coast of Scotland and England, and given us a superior crop.

The Meteorological Table annexed has reference to these remarks.

DISEASE.

Mr Halliday reports that, in all parts of the district, finger-and-toe was more prevalent than in any previous year, though the instances are comparatively few where it has perceptibly lessened the weight of the crop.

The greatest damage had been sustained on fields on Annanbank and Dalmakeddar, where turnips happened to be repeated, in each case, three times within ten years; and in other cases, where grown a second time in three years, the disease was still more injurious.

Mr Halliday observed that fields where lime had been applied within the last two or three years, seemed under all circumstances to be quite free from disease. In a field at Kirkburn, which in 1854 had been potatoes broke from lea, the yellow turnip crop of 1855 was a very large one, and quite free from disease; while in an adjoining field of similar soil, and under exactly the same circumstances on the farm, white turnips had failed from disease, confirming the opinion given by several members of the Club, that immediately after potatoes yellow or swedes should be sown in preference to white—but if the latter were grown after potatoes, the sowing should be rather late than early.

Looking to the gradual and general encroachment, and serious consequences of this disease of finger-and-toe in districts where turnips have been and are extensively sown, the Club remark that, from this as well as other reasons, arbitrary restrictions should not be enforced in leases, but that the power of changing should be left in a liberal manner to the tenant's discretion.

WIDTH OF DRILL AND HOEING.

Mr Halliday made several remarks as to the expediency of greater attention being given to the keeping full and equal distances in hoeing; and from his observations this year of fields of swedes highly manured being much curtailed in weight, from the shaw continuing too luxuriant and excluding the air, he recommended that trial should be made of the effect of the width of drill to 30 or 32 inches compared with narrower; and he drew attention to the continued large crop on Hardgrave, where the hoeing was always at least 12 inches apart.

VARIETIES OF SEED.

As to swedes, Mr Halliday reports that *Skirving's purple top* continues to produce the heaviest crops, and its greater liability to frost is now counteracted by the almost universal practice of pitting and ploughing up. In yellow, he reports that, though there is very little admixture of seed, turnips under the same name assume different shapes and qualities in different seasons and farms,

and therefore he is at a loss to point out the most productive sorts. Of the *common kinds*, Pomeranian white seems, on the whole, still to raise the largest crops; and though in some fields the hardy green is also very heavy, there are many instances of fields where the bulbs appeared deteriorated from the fine shape and size this kind showed some years ago.

Mr Halliday suggested the advantage that would arise from farmers, who had convenience, raising their own seed from well-selected turnips.

MANURES.

The application of guano is now universal in the district, and the average quantity, it will be seen, is about 2½ cwt per Scotch, or 2 cwt per imperial acre. Accompanied by this application, we have not in any of the last six seasons seen so little difference in the weights, particularly in the common turnips, by a greater or less quantity of dung, which has been, no doubt, owing to the extraordinary growth occasioned by the very high temperature and forcing weather of July. The very greatest crops of swedes, it will be seen, are where bones, raw or dissolved, as well as guano, are added to the dung; and indeed it seems beyond doubt that the additional expense of 25s. per imperial acre for raw bones, or 15s. for dissolved bones, will produce the additional quantity of turnips at a very low rate per ton, besides adding much to the permanent condition of the land; and all farmers who do not consume with sheep on the land would now universally use them could they be had with facility. The want of any bone-mill in the district is much felt in this respect. On the farms reported on, there are taken off the land for consumption about two-thirds of the swedes, rather under half of the yellow turnips, and about one-third of the white crops.

TABLE OF RAIN REFERRED TO IN THE REPORT.

	1854.		1855.	
	Upper Annandale.	Perthshire. Bridge of Earn.	Upper Annandale.	Perthshire. Bridge of Earn.
	Inches.	Inches.	Inches.	Inches.
June, ...	5.04	4.1	3.33	2.00
July, ...	3.45	2.3	4.41	4.50
August, ...	5.14	1.5	5.91	3.50
September, . . .	2.30	1.5	0.78	0.20
October, ...	4.86	2.5	6.02	3.00
Aggregate of these five months, .	20.79	11.9	20.45	13.20

PEAT MOSS AS A COMPOST.

By JOHN LOCKHART MORTON, Edinburgh.

[Premium—The Gold Medal.]

THE action of peat as a manure depends both on chemical and mechanical principles. Its qualities chemically have necessarily a very close relation, in the first place, to the plants from the growth and decay of which it has had its origin; and, in the second place, are to some extent dependent on the climate under which the deposit has been formed. Some analyses, which will afterwards be given, clearly demonstrate the fact, that in the ashes—not to speak of the organic part of peat—there is very great variation. So much so, indeed, is this the case, that one variety of peat is found absolutely injurious to vegetation, while another is capable of forming excellent composts. In its natural antiseptic state, peat is not in a condition to promote the growth of vegetables, but when reduced to its simple elements, it is calculated, when applied in sufficient quantity, to nourish in perfection the species of plants from which it has principally been formed. But as these plants must have contained a greater or smaller proportion of the inorganic substances formed in cultivated crops, their products are certain to be more or less valuable as mineral manures, in proportion to their richness in these elements. This is taking for granted that it is the mere ash of peat which is of manurial value; but the fact must not be overlooked, that dead organic matter has a very important influence, when solubilised, in promoting the growth of living organic structures. The carbonic acid of peat can differ in no respect from that found in field-plants, and must therefore, under certain circumstances, which will be referred to in due time, minister both directly and indirectly to the nourishment of cultivated crops on being generated in the soil. The mechanical qualities of peat depend not only on the proportion which the remains of one species of plant bear to those of another, but on the comparative wetness and state of intermixture with earthy substances of different deposits. If fermentation has been partially promoted during the formation of the deposit, its mechanical as well as its chemical quality must have undergone various important changes. Having made these general preliminary remarks, we proceed now to consider in detail the theory on which the practice of compounding peat as a fertiliser must be founded, if its action is to be understood and profitably regulated.

THE PROPERTIES OF PEAT.

In Dr Rennie's essays on peat moss, published in 1810, with a dedication to the President and Members of the Highland Society of Scotland, the following remarks occur:—"If moss

consists entirely of vegetable matter, and if that matter has undergone the necessary changes and combination, it seems reasonable to conclude that it may be converted both into a soil and a manure, or perform some other useful purpose. Of whatever description it may be, whether fibrous or compact, whether composed of ligneous or aquatic plants, it is obvious that it may be made subservient to important purposes." These conclusions were arrived at after a consideration of the composition of peat as known at that period, and they are equally sound in our own day, when much more knowledge is possessed on the subject. Unfortunately very few analyses have been made of peat in its natural state, but the composition of its charcoal and its inorganic part has been pretty fully investigated. The ash of Irish peat generally contains a larger proportion of calcareous matter than that of many other peats—this property being dependent on the quality of the soil upon which the deposit has been formed. As the plants employed in forming the lower layer of peaty matter would of necessity partake of the mineral peculiarities of the soil itself, and these again to some extent contribute to the production of plants having a resemblance in composition, this fact is very easily explained. A compost formed from peat, for example, incumbent on a calcareous soil, is likely, when prepared in a proper way, to be of greater manurial value on soils requiring lime, than that taken from a peat moss formed on a barren stiff greyish clay interspersed with layers of white eating sand. The plants forming the bottom layer in the latter case would inevitably be poor in fertilising substances, and affect more or less the nature of the entire deposit. The determination of the manurial qualities of peat becomes therefore a matter of primary importance to the farmer, who is about to use it in forming compost-heaps. The work in compounding a worthless substance is just as great as in preparing one of better quality, and then the disappointment produced by the failure of the former does a serious injury to the cause of agricultural progress. Considering the enormous extent of our peat bogs, and the practical uses to which the larger proportion of them may be turned, either by their being improved *in situ*, or gradually transported to other situations for manurial purposes, it is not too much to say that the progress of agriculture may be promoted to a considerable extent by such means, if they are carried out on proper principles. Some years ago a good deal of noise was made by the Directors of the Irish Amelioration Society, respecting the high manurial value of peat charcoal, both as an absorbent of ammonia and a direct fertiliser. Unfortunately for the scheme which had then been set on foot, Dr Anderson recorded, in the *Transactions of the Highland and Agricultural Society of Scotland for March* 1851, the results of some elaborate investigations he had made to ascertain the absorptive power possessed, both by peat charcoal and dried peat when saturated

with ammonia in solution. By these excellently conducted experiments it appears that even Irish peat charcoal is so limitedly an absorbent of ammonia, as to be practically in that respect of no value to the farmer. With ordinary dried peat, obtained from a moss on Mr Hall Maxwell's estate in Renfrewshire, the case was very different. While the soft spongy kinds of peat were found to absorb more ammonia than those taken from the dense bottom layers, the average quantity an ordinary sample retained, even after being dried in the open air, amounted to about 1.5 per cent of its own weight. On this point Dr Anderson observes that the "per-centage of ammonia may appear small, but it must be recollected that it is more than three times as much as is contained in farmyard manure of ordinary quality, and that the addition of even a small proportion of peat to the dung-heaps would be likely to retain in a completely satisfactory manner any ammonia which existed there in a volatile state."

The value of dried peat as an absorbent of ammonia is therefore very clearly established; but peat charcoal, while no doubt acting effectively in some cases as a deodoriser in hospitals, is proved by these researches to have very little absorptive power over ammonia suspended in water, and is in that aspect almost valueless to the agriculturist. Neither, however, as a direct fertiliser, in virtue of its inorganic constituents, is peat charcoal of great practical value; and as it takes four tons of dried peat to make one of charcoal, the loss in its manufacture is considerable. The following are analyses of two samples of charcoal, the first being the manufacture of the Irish Amelioration Society, and the other that of a private proprietor at Mount Leinster in Ireland:—

Carbon,	79.24	81.20
Hydrogen,	2.20	2.16
Nitrogen,	0.54	0.50
Oxygen,	6.44	6.24
Sand and clay,	2.48	2.10
Oxide of iron,	1.66	0.56
Phosphoric acid,	0.34	0.35
Silicate of potash,	0.98	0.96
Chloride of sodium,	2.53	2.50
Carbonate of lime,	1.85	1.87
Sulphate of lime,	1.44	1.45
Loss,	0.30	0.11
	100.00	100.00

From an estimate made by Dr Anderson of the money value of the sample the constituents of which are given in the first column, it appeared to contain—

	Value.
12 lb. of ammonia,	£0 6 0
7½ ... phosphoric acid,	0 0 11
11 ... potash,	0 2 1
	£0 9 0

In examining another and a better charcoal than the above, he found that a ton should produce—

	Value.
20 lb. of ammonia, ...	£0 10 0
2 ... phosphoric acid, . . .	0 0 3
11 ... potash, ...	0 2 1
	£0 12 4

This is assuming, certainly, that the carbon of the charcoal has no value as a fertiliser. From the carbonic acid which is developed by its *slow* decay when in a powdered state, some nourishment must be afforded to growing plants; but this can only be an almost inappreciable quantity. When Liebig remarks that "charcoal in a state of powder must be considered as a very powerful means of promoting the growth of plants on heavy soils, and particularly on such as consist of argillaceous earth," he clearly points to the fact that, in addition to its principal manurial ingredients, its greatest effects are mechanical in opening up compact clayey soils and exposing them to atmospheric agency. While Irish charcoal usually sold at 35s. a ton, the loss to the purchasers at this price must have been very considerable, as indicated by a comparison of its intrinsic value with the price charged for it. If peat is to be of much value as a manure, it must therefore be used in some other form than in a charred state. Before referring to the composition of the ashes of such peats as are likely to be adapted for the formation of composts, it may be well to notice a fact recently pointed out by Dr Anderson, explanatory of the barrenness in some cases of peat soils. By the following analysis of a portion of charred peat taken from a peaty soil at Achanrigh which refused to produce crops, the oxides of iron appear to have been the noxious elements :—

Potash, ...	0.74
Soda, ...	0.99
Magnesia, ...	0.40
Lime, ...	1.18
Protoxide and peroxide of iron, . . .	30.72
Sulphuric acid, ...	5.52
Sand, ...	42.74
Charcoal, ...	17.68
Loss, ...	0.03
	100.00

The small quantity of lime in this peat ash is somewhat remarkable, and the large proportion of iron stated to be in the form of protoxide, when taken in connection with the sulphuric acid present, indicate that sulphuret of iron has been the cause of infertility. "This sulphuret *during the burning of the peat*," remarks the professor, "has been oxidised, a part of its sulphur driven off, and the rest converted into sulphuric acid, the iron having been at

the same time converted partly into protoxide and partly into peroxide, the quantity of air not having been sufficiently large to bring it entirely into the latter condition. Now, these facts are sufficient to account in the most satisfactory manner for the infertility of this peat; for nothing is more thoroughly established than that sulphuret and protoxide of iron are highly injurious to vegetation, and act, in fact, as a positive poison to plants." The point, then, is also very clearly established, that, in using peat as a compost, the farmer would require, by analysis or otherwise, to discriminate between a material which might have considerable value as a manure, and such as would, on the other hand, prove rather injurious to vegetation than anything else. By other analyses made in the laboratory of Professor Anderson, we find considerable variation in the constituents of peat of good quality. Thus, in a sample from Dargavel, taken at different depths, the nitrogen and water varied a good deal in quantity :—

	Nitrogen.	Water.
Surface,	0.806	13.31
2½ feet deep,	0.910	15.89
3½ "	1.107	13.23
4½ "	1.023	14.06

In another analysis, peat from Dalmahoy moss gave—

Water,	15.22
Vegetable,	49.44
Ash,	35.34
	100.00

Taking the composition of the ashes of these peats as an accurate test of their value as mineral manures, the contrasted analyses will be useful :

	Dargavel.	Dalmahoy.
Silica,	21.92	81.61
Peroxide of iron,	10.91	12.54
Alumina,	7.09	1.85
Lime,	10.13	1.31
Magnesia,	11.71	...
Potash,	2.41	0.46
Soda,	5.10	...
Chloride of sodium,	...	0.13
Sulphuric acid,	11.38	2.02
Phosphoric acid,	1.62	traces.
Chlorine,	0.57	...
Charcoal,	16.99	...
Loss,	0.17	0.08
	100.00	100.00

The large quantity of silica in the Dalmahoy peat shows it to be more largely intermixed with silicious matter than is common in flow moss; a quality which it possibly owes to the layer of subsoil immediately underneath the deposit being of a sandy nature. In the case of the Dargavel moss, the presence of 7 per

cent of alumina shows it to be incumbent on an argillaceous stratum; while the lime it contains affords conclusive evidence that calcareous applications are less necessary on it than on some other kinds of peat soils. Altogether it is an excellent peat, and should yield crops of good quality. Two samples of peat ashes from different parts of Berkshire have been analysed by Dr Lyon Playfair, but the proportion of lime in these is so large as to render them suitable substitutes for that mineral. They also contain both sulphates and phosphates, which give them considerable value.

Carbonate of lime,	65.20	58.00
Oxide of iron,	2.63	4.25
Alumina,	0.03	
Silica (soluble in acids),	1.10	1.12
Sulphate of potash,	2.15	0.37
Sulphate of soda,	1.16	trace.
Sulphate of lime,	1.11	2.88
Phosphate of magnesia,	0.37	0.46
Chlorine,	trace.	trace.
Organic matter,	4.81	4.25
Sand and clay,	14.01	11.19
Water,	7.31	17.21
Loss,	0.12	0.27
	100.00	100.00

These ashes are to be regarded as of superior quality to most others that are sold as fertilisers; and it must be admitted that without some such data as an accurate analysis to go upon, it is altogether a random and unsafe practice to purchase peat ash either of home or foreign preparation, for manurial purposes. In Belgium and Holland peat ash is extensively used as a manure, at the rate of about 20 bushels per acre; but, with very great variation in quality, its action cannot be alike profitable in all cases. Professor Anderson has shown that some specimens of Dutch peat ashes are of very inferior quality as fertilisers. Other and better qualities, no doubt, contain considerable quantities of phosphates and sulphates, some of the plants from which peat is produced yielding phosphoric acid and sulphate of soda; but in general, imported peat ash is far from being rich in these ingredients. The decision arrived at by Dr Lyon Playfair appears to be a sound one, and may here be quoted:—"An analysis of the evidence on the value of peat ashes leads us to the conclusion that different kinds vary much in their composition, some varieties being of no greater value than common marl; while others contain both earthy and alkaline sulphates, and more rarely earthy phosphates, all of which impart great worth to them as manure."

If peat is found, therefore, to be in general of *comparatively* little value as a manure, employed either in a charred condition or merely as an ash; while, on the other hand, its efficiency almost in its natural state, both as an absorbent and a direct fertiliser, is distinctly proved,

the next point to be determined is the best system of selecting and preparing it for use in compost heaps.

SELECTION AND PREPARATION OF PEAT.

Those peat mosses which are most capable of being successfully reclaimed, must necessarily yield the best material for compounding purposes. The improvable quality of peat deposits is usually ascertained by the plants which grow upon them naturally, and similar means will suffice as a partial test in selecting the quality suitable for composts. On moss of the poorest kind, the principal plants are *Calluna vulgaris* (common heather), in a dwarf state; *Erica tetralix* (cross-leaved heath); some of the smaller rushes, (*Luzula* and *Juncus*;) and a few species of the smallest and least nutritious kinds of *carex* grasses. Where no other plants than these are found growing on the surface, the peat is not likely to be of the best quality; and in absence of analysis, they afford a very fair criterion of the limited value of its constituents. But should the heather be strong in the stem, and abundance of the ranker species of the *cariceæ* tribe of grasses, and occasional plants of *Rumex acetosa* (common sorrel), *Ranunculus repens* (*crowsfoot*), and *Senecio jacobea* (ragwort), be found growing on the drier or more earthy spots, then the quality is likely to be of considerable value for top-dressings. On the outer margins of large peat-mosses, there is usually more or less floated material, containing a considerable proportion of earthy ingredients. The fertility of this alluvial peat is generally indicated very distinctly by its herbage, which, for rankness as well as fineness of quality, resembles the yield of some highly productive meadow. If a choice between this kind of peaty matter and that of deep flow-moss exists in any case, the farmer will do well to use up the former before beginning to the latter; or perhaps better still, mix the two together in equal proportions. In selecting the point of a flow-moss from which the peat required for manure is to be taken, it is necessary in most cases to be regulated by the roads which are in existence; but certainly if there is one part which has a stronger and better class of vegetation than another, means of approaching it should if possible be provided. The surface layer in most cases is not of so good quality as that found at a depth of three to four feet. It may, in virtue of its porosity, be a superior absorbent, but in itself is not so rich in the elements of fertility as the peat got at a greater depth. This rule, however, cannot apply to every moss, and the only safe data for the farmer to go upon, is to ascertain, by analyses of specimens from different depths, the respective properties of each. As a general rule, the fibrous, brown-coloured, greasy peat, which is sufficiently compressed to cut readily in whole spits, but not to make the hardest and best fuel, is preferable for composts to the lower compact black layers, considered best for the latter purpose.

As exposure to atmospheric agency is indispensably necessary, it should be dug out from its natural bed a considerable time before being required for use. The usual practice is to wheel out and leave it in *large heaps* for some months; but this is a most defective method of preparation. From the antiseptic nature of peat moisture, it must be carried off as completely as possible by evaporation, and its astringent principle completely oxidised by exposure to the oxygen of the air, if it is to be in the best condition for agricultural use. Its mechanical reduction is also greatly promoted by the action of frost; and for these various reasons, therefore, care should be taken to wheel it out in the beginning of winter, and leave it in a thin layer to the middle or end of the following summer. When it is practicable to get it spread out ten inches or a foot thick, on a piece of bare pasture-ground, it can be turned several times during the period it is being dried with very little trouble; and the oftener it is so, the greater will the results be. In the course of turning it, the tools should be employed as much as possible in reducing the spits; but even with considerable care in this respect, some extra work will be necessary to bring it into the uniformly pulverulent state which is requisite to the securing of its maximum effects as a fertiliser. Should the peat used be of too small a quantity to warrant the erection of some sort of grating machine capable of reducing it to a powder, then there is nothing for it but to set female workers to hack down the larger pieces with hand tools as completely as they can. For the more extensive reduction of peat, an efficient apparatus might be constructed at very little expense. The principal parts of the erection would require to be an oblong stout frame, fitted with ribs of flat wrought-iron on edge, placed about two inches apart. Above this horizontal framework, which should be securely fixed in its place, a movable wood frame of half the length of the other, fitted up with a great number of strong vertical knives, to work in the spaces between the fixed iron bars, will next be necessary. By means of a crank or serpentine wheel, the upper frame may receive a horizontal motion; and as the peat comes between the fixed and movable frames, the knives, by a particular arrangement, will force it against the fixed ribs, when, being severed by the cutters, it will fall into an open space below. To allow the material to reach the iron bars readily, the movable frame, whether of iron or wood, should be made as open as possible; and a contracting hopper being placed above, sufficient weight will be afforded by the peat itself to press the undermost layer upon the sparred framing. The size of the fixed framework need not be more than 6 feet long and 3 feet wide, while the travelling cutter-frame will be of sufficient size if 3 feet square. In the latter there must, of course, be a row of knives to suit each space between the ribs of the fixed fittings, and the cutting blades should not be more than 6 inches separate in the row.

By means of either steam, horse, or hand power, this peat pulveriser may be wrought in a most effective manner; and a large quantity of material being reduced in a very short time, the expense will be comparatively little by the ton. The first expense of such an apparatus could not be very much—not more, perhaps, in any case than £25; and if fitted up in a coarser and less substantial manner, the half of this sum would possibly suffice. It cannot be too much impressed on the minds of those who intend to apply peat as a compost, that a thorough breaking up of its natural compacture is absolutely required; and every one who has attempted to reduce it by common hand tools, knows what an amount of labour is entailed in the operation, and how necessary it is to have some mechanical appliance to lessen it. When once the moss has been well dried and broken down, the mode in which it is to be employed—whether alone or mixed with other substances, and whether in ordinary manure-heaps or in absorbing the drainings of dwelling-houses and cattle-stalls—must be put into practical operation.

MIXING AND APPLICATION.

The great end in drying peat and reducing it to a powdery state, is to secure its complete fermentation, either in the soil, on being applied to it, or in a heap, mixed with some other material which will absorb the carbonic acid liberated in the act of decomposition. Some writers, and, amongst others, Mr Lawes of Rothamsted, before his position as an authoritative agricultural experimentalist was called in question, have assumed that the doctrine propounded by Baron Liebig taught that carbonic acid applied to the roots of plants was altogether unnecessary, and without effect, as the atmosphere could supply it by the leaves in sufficient abundance. The statement made by Liebig was to the effect that, with the other ingredients required to develop cultivated plants, supplied to their roots in the proper proportion, the co-operation of the atmosphere would, in *that case*, be sufficient to afford by the leaves the necessary carbon for their structures. In his new work on agricultural chemistry, which has special reference to Mr Lawes' experiments, the great chemist states, in the seventh proposition of the fifty he lays down, this important principle: "The roots of plants, in regard to the absorption of their atmospherical food, behave like the leaves; that is, they possess, like these, the power of absorbing carbonic acid and ammonia, and of employing these in their organism in the same way as if the absorption had taken place through the leaves."

Again, at page 22, proposition 18th, he says, "Of two fields of equal quality, and containing equal amounts of mineral constituents adapted to vegetable growth, but one of which contains a *source of carbonic acid* in the form of decaying organic matter or

manure, that one even in dry years yields more produce than the other." In some cases it is not so much the action of the carbonic acid of the peat in building up *directly* the structure of the plant to which it is applied, that is requisite, as *the decomposition by its agency, in the soil, of the mineral ingredients which are necessary to secure, within a certain time,* the elaboration of the vegetable structures that are to be grown. These are points of the first importance, and completely explain the reasons why peat ought to be regarded as a manure of no mean order. They further, by natural inference, point to the fact, that unless the peat is prepared in such a way as to secure its decomposition, and thereby the production of carbonic acid, it will not serve the end in view. When applied in a lumpy state, it may prove a mechanical manure, and open up a stiff clay-soil, but certainly it will not act as a chemical agent to any great extent. If thoroughly reduced to a powder, and applied in the spring months to pasture land, it will, no doubt, even without any other material, do a considerable amount of good; but this is not the way to employ it to the best advantage. There are many different plans which might be adopted, eminently calculated to convert peat into a first-class compost; and a few of the best may be stated. Earthy material, such as ditch-scourings, road-scrapings, or carried soil on turning ridges, is to be had in larger or smaller quantities on every farm; and being an excellent absorbent of gases liberated in the decomposition of the peat, it is a very suitable substance to mix with it. To promote fermentation, a layer of dried peat, 3 or 4 inches in thickness, should be moistened either with liquid manure, diluted gas-work ammoniacal water, or distillery wash. Over the peat so treated a layer of soil 2 or 3 inches thick should next be laid, then another stratum of peat and earth in alternation, till the compost heap is of the necessary size. If *sufficient* liquefied manure—but nothing more—has been applied to each layer of moss, so as to promote fermentation, a considerable heat will soon be felt in the heart of the heap. Should a dew appear on the surface, a little more soil will require to be laid over it, to retain the liberated gases. After lying in this state for a week or two, a dressing of liquid manure may be applied to the outer surface, but not faster than it soaks into the interior. In about a month from the time the heap has been formed—or more, if it is the winter season—the compost may be turned over, and again moistened with one or other of the liquid manures which have been mentioned. A second fermentation will then begin, which being over in a week or ten days, the compound will be nearly ready for being applied to the land. As a top-dressing for pasture ground, this mixture will be found in many cases a fertiliser of greater potency than some more expensive preparations. When the soil to which it is to be applied is not of a calcareous nature, a little powdered lime sprinkled over the moss,

both in making up the heap and turning it, will be of essential service. Unless too large a quantity is used, no evil effects will result from the ammonia of the liquid manure being brought into contact with the lime. In the course of my experience, principally on stiff clayey soils, I have seen as rich dark green herbage produced by a top-dressing of this nature, as with lime, or even compost consisting of police manure, soot, and earthy matter. It is necessarily of less strength, weight for weight, than dung composts; but as its cost consists principally of expended labour, a thicker coating can be afforded than with purchased materials. As a general rule it is a compost which continues to act for a considerable time; and with a little guano—say at the rate of from 1 to 1½ cwt. per acre—mixed with it, a more rapid action may be secured at first than would be the case without it. I have always found that guano used along with fermented peat, either in composts or in drills, for ordinary green crops, gave a more satisfactory return than when used alone. While the carbonic acid of the peat which has been absorbed by the soil acts on the mineral matters it comes in contact with, the ammonia and phosphates of the guano co-operate with it, and the result is an elaborated crop, *provided the soil is otherwise suitable for producing it.* The latter proviso is a most important one, and should not be lost sight of, as a case in point will show. In 1853 a Scotch farmer, whose land is principally situated on the coal formation, and is mostly of a stiff, clayey nature, employed dried pulverulent peat as a manure for potatoes, both alone and with other substances. The ground to which he applied it, though somewhat tenacious in texture, was in very good condition. Used alone, 20 cartloads of dried peat per acre gave a very fair crop, which, being free from disease, was nearly of equal value to the heavier produce after farmyard dung. With guano and peat the return was still better; and, altogether, the varied experiments he conducted led to the conclusion that, under certain circumstances, dried peat would become of value as a fertiliser. In 1854 he again conducted a series of similar experiments; but this time the land he had to deal with was of thin, poor quality, a good deal intermixed with white sand. The result of his attempts in this case proved, very distinctly, that, with a liberal dressing of farmyard manure, he could raise very good potatoes on such a soil, but that dried peat was of no value whatever; the soil in its natural state, poor as it was, actually yielding, without any manure, as many tubers as when dressed with peat. When applied along with 2½ cwts. of guano per acre, the yield was only as much better as one might have expected from a portable application of this nature, had nothing else been given along with it. Now, this result is exactly that which the teachings of science might have led one to expect, as another quotation from Liebig's last publication will show. In his 43d proposition he

says, "The efficacy of the *atmospheric constituents* (carbonic acid and ammonia) in a given time depends on the co-operation of the *mineral constituents* in the same time. If the latter be present in due proportion and in available forms, the development of the plants is in proportion to the supply and assimilation of their atmospheric food." Again, at page 33, in proposition 46th: "The supply of more atmospheric food (carbonic acid and ammonia, by means of ammoniacal salts and humus) than the air can furnish, increases the efficacy of the mineral constituents *present in the soil* in a given time. From the same surface there is thus obtained in that time a heavier produce—perhaps in one year as much as in two without this excess of atmospheric food." When it is remembered that the principal product of decomposed peat is carbonic acid and a very little ammonia—compounds which, while incapable in themselves of building up vegetable structures, are yet eminently adapted for co-operating with other substances in effecting the elaboration of plants—the reason of its successful action in one case, and not in another, is easily understood. Like a piece of old cheese in a full stomach, fermented peat is an excellent digesting agent when applied to a well-stored soil, but on land *poor in mineral* elements, its beneficial effects are confined to the trifling inorganic ingredients yielded by itself. The same rules, of course, which ought to guide the farmer in the application of peat to drilled crops, should do so also in employing it as a compost. If used alone in top-dressing very poor land, much good need not be expected; but on the old "fogged" pasture of earthy or clay soils, or even on any land of ordinary quality, it must have a beneficial influence.

To insure a maximum effect from peat as a manure, it must be reiterated that the really judicious course is to compound it with other substances which may be improved in quality by its action, and which may in return increase its fertilising effect. Thus, in mixing dried peat and soil together, and moistening them with liquid manure, as described in a previous page, a series of very important changes are effected. By the application of moisture to the peat, fermentation is promoted, and carbonic acid and ammonia are given off by it and the liquid manure. But these valuable substances are not allowed to escape, for the soil mixed in the heap at once absorbs and retains them. On a further application of ammoniacal liquid, the portion of peat remaining in an undecomposed state drinks it up, and is thus either further fermented, or at least improved in quality. When caustic lime and peat are mixed together in composts, a mutual change is effected, which it is most important that the farmer should understand. Dried peat of fair quality contains from 1 to 1¼ per cent of nitrogen; and this substance, when brought in contact with lime, is converted into ammonia. Carbonic acid being given off at the same time, this

ammonia is partially converted into a carbonate, which, being a very volatile substance, is likely to be dissipated to some extent, unless there is a large covering of moist peat on the outside, or layers of earth mixed with the other substances in the interior of the heap. In general, peat moss intended to be compounded with lime, should be rather in a moist than a dry state; and not having previously been fermented, the humic and ulmic acids given off will produce humate and ulmate of lime. If a large quantity of carbonic acid is liberated by the peat, the lime will necessarily to some extent be converted into an insoluble carbonate; but with a continued absorption of carbonic acid, it soon becomes a *soluble bi-carbonate*. In this way nature helps the farmer to produce, with good management, a compost of lime and peat which, from its fertilising properties being in a soluble form, is at once ready to take a part in the elaboration of plants. It must be admitted, however, that the most prudent course in preparing lime and peat composts, is to intermix such a quantity of earthy material with them as shall be sufficient in all cases to absorb the gases which might otherwise escape into the atmosphere. By the elaborate researches of Professor Way, the decomposing and absorbing powers of earth, particularly if it be somewhat clayey in its nature, are so thoroughly established as to afford perfect confidence in its use as an absorbent. When lime, moss, and earth are suitably prepared together, a most excellent top-dressing for pasture-land is the result. Even on ground which has previously been lying in a dormant state, not from the want of the elements of fertility, but because of the absence of an active principle to put them in operation, I have found a mixed manure of this kind produce an oat crop double the value of that grown the year before. But its greatest effects will be realised on grass lands, with a dressing of from 20 to 25 tons per acre, according to the richness of the compound. A very good proportion for the various substances to bear to each other is 4 tons of lime-shells, 12 to 15 large loads of peat, and 4 to 5 tons of earthy matter. For an acre this will be found a liberal dressing; and, speaking from experience, I can insure its profitable action on any kind of pasture grounds, except those which either are naturally *very poor*, or lying on the limestone formation. This compost, as well as others, may be made up in the winter season under cover, as will be afterwards described, and should be applied in the month of March or beginning of April. It is not necessary that the various substances should be kept together more than six weeks or two months, if even so long; and during that period it is requisite to turn the heaps once or twice, and to act with such caution as shall prevent the peat taking fire by the action of the lime.

Another way in which peat can be rendered of great manurial value on some farms, is to mix it with byre and stable dung. The

practice of laying a thick stratum of moist peat in the bottom of the manure-heap has long been followed in some districts; but unless more care than is usually exercised is taken to dry it, comparatively little good is effected. The right plan is to dry the peat as thoroughly as possible; and having reduced it to a powder, the liquid drainings will promote its fermentation, and convert it into an actual manure. One extensive landed proprietor, known to the writer, uses very large quantities of peat in this way, and the result is, that he can grow double the acreage of turnips on his home farm that any neighbouring farmer keeping the same number of stock can do. He also mixes earth, stable manure, fallow rack, lime, and peat together, and, applying to the heaps from time to time a dressing of tank liquid, he can give the compost any degree of richness he may wish. In adopting this system of preparing mixed composts, peat, when available at no other expense than that of a short cartage, can be rendered a valuable and highly remunerative manure. As a practical illustration of the value of peat top-dressing to pasture land, even when it is prepared on somewhat expensive principles, it may be well to notice, in general terms, an experiment made by the writer in 1848. Some years previously to that period, several hundred cartloads of peat had been laid down in a pasture field, with the intention of forming from it and other materials a monster compost-heap. For some reason or other the intention was never put into practice, and by-and-by the heap became a nuisance, which required to be removed to conceal discreditably broken-off purposes. An attempt was made to char a part of it; but the difficulty of getting the fire put out after being kindled, soon put this system out of thought. The next course which appeared advisable was to mix it with earth and moisten it with urine from the cattle stalls. This was soon done, one cart of earthy refuse matter being mixed in layers with rather more than two carts of reduced peat. A small quantity of stall dung was also mixed with the compost, and by occasional dressings with liquid manure it was ere long in excellent condition to be carted out to the land. At a distance of about half a mile there was a stiff clay pasture field, likely to be more benefited by a top-dressing with such a compost than the pasturage immediately around the heap, and to it accordingly the application was made. The soil was poor, but its poverty did not arise from a deficiency of inorganic ingredients, but rather from their being in an insoluble form. About 20 carts of the compost were applied to the acre in the winter months, and brush-harrowed in spring with the late Mr Smith of Deanston's apparatus for the purpose. The young grass came up much fresher and quicker than usual; and, being greatly increased in thickness of the sole, was found to keep a greater number of stock all the time it lay in pasture than it had previously done. When broken up several years after and put

under a cereal crop, the yield was much better than had been anticipated, and there was then very little appearance of the peat which had been applied to it. It happened, at the same time, that an adjoining field, consisting of land very similar in quality, was top-dressed in sections with different kinds of composts; one consisting entirely of earth, another of lime and earth, and a third of wood-sawings and refuse matters of a carpenter's workshop, partly in a charred state and partly rotted. While the earth, though evidently inferior to the peat-compost, improved the pasturage to some extent, the refuse ligneous matter made an almost imperceptible improvement upon it. The action of the lime compost was comparatively little noticed the first year, but afterwards it was certainly superior to the peat-dressing; but then it was more expensive, as will be seen from the contrasted cost by the acre :—

Lime compost, 4½ tons lime-shells, including cartage, at 11s. 6d., ...	£2	11	9
14 tons of earth (collected), at 3d., . .	0	3	6
Carting out the prepared compound, 18½ tons, at 6d.,	0	9	3
Making up and turning heaps, and spreading the compost on the land, . . .	0	5	0
Total expense,	£3	9	6

Peat compost, 14 carts wheeling out from moss, turning and removing it to place where to be compounded, at 5d., ...	£0	5	10
6 carts of earth collected together, at 3d., .	0	1	6
1 ton of stall manure, at 4s., . . .	0	4	0
Tank liquid, say 2½ barrels, ...	0	2	6
Carting out the prepared compound, 21 tons, at 6d.,	0	10	6
Making up and turning heaps, spreading on land, &c.,	0	6	0
	£1	10	4

The peat cost less than the half of the lime compound, and, on the whole, was more remunerative when compared with the first outlay. An increased grass rental of 2s. per acre would have left good interest on the expenditure connected with the peat application; but the actual result was this: After the first year the peat-dressed pasturage, when let for the season by public auction, brought, for some years, from 7s. 6d. to 10s. an acre of advance rent, while the lime top-dressed field did not bring so much by a shilling or two. The reason of this discrepancy is to be found in the fact that the portion of the latter field, dressed only with half decomposed woody matter, was very little improved. It is not to be supposed, however, that the peat-compost could continue for several years to exercise *directly* much effect on the growth of the pasturage; but having once improved it, and rendered the field capable of keeping a greater number of feeding cattle than before, the first improvement and its effects continued to exercise a bene-

ficial influence in after years. The profitableness of such an application in comparison to that of other kinds of top-dressings, must depend, to a considerable extent, both on the quality of the peat and on the facility with which it can be obtained for this purpose. In the better cultivated parts of the United Kingdom, peat is not to be obtained on the spot; but in many districts it is available in limited quantity, and certainly in these situations it is deserving of much more general use for compounding purposes than has hitherto been thought advisable. In employing *dried* peat as an absorbent, hundreds of tons of first-class manure can sometimes be made in the vicinity of a single town or small village. The drainage systems of our towns are usually so defective in their nature, that the sewage water is permitted to run off in any way the declivity of surface may determine. Now, in any instance where a ditch, regularly or at intervals, contains water so rich in phosphates and ammonia as street and house drainage is known to be, a favourable opportunity exists, if peat is available, for turning it to profitable account. By taking care to have the peat-moss in a tolerably dry state before it is put into the ditch to drink up the liquid, it will be found to absorb sufficient manurial elements to render it a fertiliser of as great potency as the best farmyard manure. It may not last quite so long, but its action at the first will be much greater than most kinds of ordinary manure. Where there is a sufficient quantity of moisture to saturate the moss in the ditch, it will not require to remain in it more than a very few weeks, and during that period one turning will be quite sufficient. For the production of turnips, 20 to 25 cartloads of this saturated material, and 3 cwts. of guano, will be found a first-class application. On *pasture-land* it should not be used alone, as a part of its ammonia is likely to escape before it is grown over by the grasses; but it may be carefully mixed with soil, and, after lying for a few weeks in a well compressed heap, may be applied without any risk of this sort being experienced. After an application of this kind, I have repeatedly observed a very great improvement in the quality of the pasturage, coarse carex grasses gradually giving place to the crested dogs-tail (*Cynosurus cristatus*), and sweet-scented vernal grasses (*Anthoxanthum odoratum*). It is not such an easy matter to ferment saturated peat as that which is only from time to time moistened with tank liquid; but if formed into heaps with plenty of soil, and some long stable manure, or vegetable refuse, such as weeds and hedge clippings, a decomposing heat may be induced. The gases liberated in this case will be taken up by the soil, which must be present in sufficient abundance to prevent the escape of any portion thereof. It may appear *unnecessary* to ferment peat in heaps after it has absorbed a large quantity of foul water from some sewage ditch; but to do so, is simply to help nature to effect a speedier decomposition than would

be brought about in the soil. To promote the speedy reduction of peat to its simple elements, the use of sulphuric acid (vitriol) has been recommended. From the strong affinity for water which this acid evinces, it can be employed with considerable advantage in decomposing peat which is too wet to be fermented in the ordinary way. The acid, in uniting with water, leaves the carbon of the peat almost in a charred state, and, besides, volatilises several of the other products which are present. This reduction and consequent liberation of elements is rapidly effected, and unless a large quantity of soil be intermixed with the peat, its fertilising products are likely to be lost to the farmer. Great caution must therefore be exercised in the use of sulphuric acid in preparing peat as a manure. It is a rapid means of decomposing the material and making it give up its elements; but the risk of losing some of these is very considerable.

The best method, no doubt, of securing the reduction of peat in ordinary cases is that of fermenting it; but as this implies a condition, in respect of dryness, not often attainable in the open air during the winter season, the question naturally occurs whether the existence of a roofed building for the storing of sun-dried peat and the mixing up of composts, would not be of remunerative importance in many cases. It need not be an expensive erection, for it will serve the purpose completely if it consist simply of a few pillars and a coarse thatched or boarded roof. In winter weather, when nothing else could be done out of doors, composts might here be mixed up and prepared for spring application. To prevent lateral drifting of snow or rain into the interior, a wicker fence of spruce fir branches might be provided between the pillars. Being enabled to speak, from several years' experience, of the value, in many different aspects, of an erection of this kind, I can very confidently recommend those who are in the habit of using peat as a manure, to provide themselves with some kind of roofed building, and to store up largely in it during the summer months. The facility with which peat stored in this way is fermented, gives it an additional value over that exposed to rains and snows, quite sufficient of itself to repay in a few years the first outlay on the building.

I trust that it is unnecessary to say more than has been stated in the foregoing pages, to prove that peat-compost is deserving of being extensively employed on the farm, especially on land which is stiff in its nature. The denseness of clay land is very frequently the only cause of its comparative infertility; and, apart altogether from the manurial value of an application, the extent to which it opens up the stratum of soil and exposes its insoluble organic and inorganic elements to atmospheric action, must insure its favourable agency in a greater or smaller degree. Irrespective, however, of its mechanical action on clay soils, it is hoped that the conclusions arrived at in the foregoing pages will show it to be in

reality also a direct chemical manure. Some have objected that its use has the effect of producing particular kinds of weeds on soils which are otherwise clean; but the same remark may be made of any kind of home or purchased manures. The proper plan is to keep down the weeds, and turn the nourishment which would have been expended upon them into a profitable channel. Without affirming that peat applied alone to soils of ordinary quality will prove a successful manure, it may at least be safely stated that, by properly preparing it, along with more potent fertilisers, it will prove a valuable and remunerative auxiliary on many different kinds of farms. In such places as it exists, and is easily accessible, it is surely as much the duty as the wisdom of the farmer to make the best possible use of nature's gifts. It is well enough, so long as it is necessary, to send to Peru for guano, but there can be no excuse for leaving manures, which may help to make it go considerably farther, lying at our own door uncared for and unused. Peat is worth something; therefore, by all means give it credit, after a fair practical trial, for its real value. Nothing more is asked for it in these pages; and to condemn it without such a trial, is unfair, and unworthy of enlightened minds.

ON THE RELATIONS OF TECHNOLOGY TO AGRICULTURE.

By GEORGE WILSON, M.D., F.R.S.E., Regius Professor of Technology in the University of Edinburgh, and Director of the Industrial Museum of Scotland.

(*Address to a Monthly Meeting of the Highland and Agricultural Society, January* 16, 1856.)

I SHALL take for granted in what I have to bring before you, that the Members of this Society, which has taken so zealous an interest in the establishment of an Industrial Museum here, and has farther shown its good-will by the gift to it of a valuable series of specimens, need no minute information concerning its origin, or that of the Chair of Technology, which goes with its Directorship. It is one of those institutions which had become necessary by the altered condition of the world, and the felt wants of all the intelligent sections of the community. Yet such an altered condition required to be clearly realised, and such wants to find a voice, before any steps could be taken to satisfy either the perception of a great social change, or the sense that it demanded from us an effort uncalled for before.

Setting aside altogether political causes of social alteration, which are beyond the pale of discussion here, the steam-ship, the railway, and the electric telegraph, have revealed to us the unsuspected progress which the other great nations of the earth have

been making in the industrial, as well as in the other arts; and whilst those great producers of mutation have opened to us the whole civilised world, they have also let in the whole civilised world upon us.

A perception of the risk we run of being left behind in the honourable rivalry of races, an honest admiration of the superior skill in certain arts which belongs to other peoples, and the deep conviction that the qualities of heart and intellect which have given us our place among the nations, are still, by God's favour, possessed by us, have led to the foundation of the Industrial Museum of Scotland, as one means of enabling us to learn what we need to know, and to teach what we wish to be known. No public body has done more to bring about this than the Highland and Agricultural Society, and no members of that Society have contributed more to this result than its former President, the Duke of Buccleuch, and its present able and energetic Secretary.

It is, accordingly, with the full assurance that I shall not address indifferent or unwilling listeners, that I avail myself of the opportunity now afforded me to explain, as Director of the Industrial Museum, in what way Technology may be expected to benefit agriculture.

I am met at the outset by the strangeness of the term *Technology*, which has not yet found its way to the hearty appreciation and sympathy of all. This is not to be wondered at. A living language is continually receiving additions of words, but by a process so gradual, that the advent of single terms is scarcely matter of observation among the public at large. Constant repetition will accustom us to any word, especially if it occur incidentally in the exposition of some matter in itself of engrossing interest, and be left to find its way to general reception without criticism, whether in the way of commendation or disparagement.

Witness the readiness with which all ranks of the community have learned the names of places, persons, and things connected with the Russian war, so that every one has on his lips Sebastopol, Balaklava, Kertch, Renkioi, Cronstadt, Helsingfors, Gortschakoff, Todleben, Pelissier, Della Marmora, Redan, Malakhoff, and the like. Witness also the complacency with which such terms as daguerréotype, photograph, calotype, gutta-percha, hydropathy, phrenology, have been received into our language. We have already forgotten how unwelcome, when first heard, most of those words were to us, and how unconsciously we have made them part and parcel of our language. In truth, we have learned them, as we learned our mother-tongue in childhood, by continually hearing and continually repeating them, as words for which there existed no substitutes, and whose full sound and full meaning could be acquired only by degrees.

A solitary, strange word, however, especially one which we are

not compelled by necessity to employ, cannot thrust itself at once into acceptance with the community. "Technology" must wait patiently; and till the reality which it represents is more fully brought before the public, the title of that reality cannot be matter of interest. I will only, therefore, say of the word, that for many years it has been employed on the Continent, and more recently in Great Britain and America, to signify "The Science of the Useful Arts." No more euphonious or familiar term has been suggested as equivalent in meaning; it would be difficult to find one; and into its derivation from certain Greek roots I will not enter. Its present meaning is in conformity with its derivation, but is not the only meaning which it might bear. This, however, need not concern us.

No member of this Society, I imagine, would refer an intelligent foreigner, unacquainted with Greek or Latin, to the derivation of the word *Museum* as likely to assist him in apprehending what is the object of the Society's Museum.

The dictionary, if consulted, would explain that Museum meant "the temple or haunt of the Muses;" or a "school presided over by the Æsthetical Goddesses;" or, since the days of Ptolemy Philadelphus, B. C. 280, "an institution for the promotion of learning and the support of learned men."

Now, far be it from me to say that the Muses never haunt the Highland and Agricultural Society's Museum; or that the æsthetical goddesses are not interested in its welfare; or that it has not promoted learning, or helped to support learned men; but these are not exactly the ends which it deliberately aims at securing; and our foreigner would not be much assisted in appreciating the treasures of the Museum by a knowledge of the etymology of its name. Neither probably should we be by studying the derivation of "Technology."

Let us take the word "Technology," then, without further criticism. Understood as signifying the "*Science of the Useful Arts*," it of course includes not one, but many sciences, and complaint has been made that it is thus inexplicit. But all inexplicitness separable from the subject will be removed, if it is kept in view that the Professorship of Technology and the Directorship of the Industrial Museum go together.

The duty of the one office is to collect, arrange, and preserve the objects, products, and instruments of industrial art: the duty of the other office is systematically to expound these within the walls of the University. This, however, let it be observed, is simply a University arrangement, like that which conjoins the offices of Professor of Natural History and Keeper of the Natural History Museum, and those of Professor of Botany and Keeper of the Botanic Garden, and does not exhaust the duties of the Professor of Technology.

And here it may prevent misunderstanding if I explain that, whilst the Industrial Museum is associated with the University, it is distinct from it, and included in the department of Science and Art of the Board of Trade, under whose instructions I act as Director of the Museum. With a view to prevent the needless multiplication of similar collections, and to secure economy in the expenditure of public money, and not less to secure for the Museum the important assistance which the Professors of the University can give to an institution more or less connected with all the sciences, it was deemed desirable to associate it with that academic body.

By this arrangement, also, the Natural History Museum has been transferred to the possession of the Board of Trade, and becomes in consequence open to the public. When the new buildings are erected, it is intended to arrange the Natural History objects and the Industrial collections together, or in close proximity; so that, for example, the geological relations on the one hand, and the economical relations on the other, of coal, limestone, sandstone, ironstone, and the like, may be studied by those to whom the purely scientific or the purely industrial aspect of these minerals is alone interesting; whilst the many who desire to make themselves familiar with both aspects, will find the means of doing so under the same roof, and guided by a system of arrangement which contemplates their twofold study.

The object of the Industrial Museum will thus be, to gather together all that pertains to useful art; and I will now attempt to show how Technology, the science of useful art, will benefit agriculture. This may perhaps be done better by an indirect than a direct, exposition.

Agriculture, in the wide sense in which this society encourages it, occupies the front rank among the useful arts. We believe this in peace; but we only perhaps, fully, realise it in war, when we see cities which have defied fire and sword, open their gates at the summons of famine. The definite aim of scientific agriculture I understand to be the production, season after season, from a given area of land, of the largest amount of vegetable and animal food, within the shortest period of time. Before, however, Time can be shortened, Space diminished, and Food increased, the aid of many sciences and of many arts must be called in; and the skill which only experience can give, must guide the agriculturist in availing himself of their assistance. Such experience I assume him to possess in the fullest; and I shall not discuss the purely scientific applications of astronomy, geology, mineralogy, botany, zöology, natural philosophy, meteorology, and chemistry to agriculture. A knowledge of the laws determining the seasons, the tides, the winds, the rains, the temperature of air, of land, of water—the conversion by natural processes of certain rocks into fertile soils, and of others into barren ones—the extinction or excessive development of useless or destruc-

tive plants and animals, and the converse prevalence of disease among those which are harmless and useful—and much else—would, according to the judgment of all intelligent men, be of the greatest service to the farmer. But it does not fall within the scope of an Industrial Museum to furnish illustrations of natural laws, however important, which we cannot press into our service and make the foundation of useful arts, except in so far as approved and practically available forms of such instruments as the thermometer, barometer, rain-gauge, and the like, may form part of the collection of instruments.

The great object, however, of the Industrial Museum will be to illustrate the application of science to the determination of the qualities of existing raw or initial materials, to the discovery or production of new ones, and to the derivation from familiar and from novel substances, of bodies serviceable in the arts.

Thus, to make apparent the benefits which Technology may confer upon agriculture, let us begin with the *Buildings on a Farm*, including the farm-house, cottages, offices, stables, byres, and outhouses; taking along with them, garden-walls, and all other erections involving mason-work. We will suppose a large tract of land newly brought into cultivation, and that a farm-steading is about, for the first time, to be erected upon it. A multitude of questions at once arise, which it is not the province of the agriculturist of any class to answer. Shall the walls of the several buildings be of stone, or brick, or partly of both? In so far as they are of stone, shall granite, or whinstone, or sandstone, or limestone be preferred? Supposing all of those equally attainable, what considerations should determine a choice of one of them, rather than of another? How far do they differ in hardness, compactness, durability, permeability to moisture, tendency to stain, or discolour, and indifference in general to the action of rain, wind, and weather, and to what extent are some of them more quickly, cheaply, and neatly quarried, chiselled, carved, and polished than others? Whether, if the choice be between two kinds of rock only, is granite preferable to whinstone, or sandstone to limestone, as a building-material? If the choice be restricted to sandstones, will it make any difference whether the rock selected belong to the old red sandstone, the new red, or the sandstone of the coal formation? If but one of those sandstones be accessible, how far will the presence of clay, lime, magnesia, iron and coaly matter, affect the building-value of one bed of rock, as compared with another from the same or a similar quarry? If we must choose among limestones, should we prefer the dark or the light coloured, the shelly, the earthy, or the crystalline; those which are purely calcareous, or the magnesian limestones?

Those questions might be greatly multiplied, but this is needless. The problems referred to are some among the many which

all must encounter who select building-materials, and as yet we can but imperfectly solve most of them. Now, one object of the Industrial Museum will be to collect specimens of all the building-stones of Great Britain, and, as far as shall prove possible, of the world. One object of the Analytical Laboratory attached to that Museum will be the analysis of such stones, with a view to discover how good and bad building qualities stand related to the presence or absence of certain ingredients; and one important duty of the Professor of Technology will be to make the results of such researches known by lecture, exposition, and publication to the entire community.

Again, having selected a building-stone, we propose to build; but difficulties arise regarding the mortar. What kind of lime is best for making mortar? what kind of sand? and in what proportion is it best to mix them? Is it true that walls cemented by mortar containing sea-sand are always wet, and that if we wish dry walls we should select pit sand, whatever its quality or cost may be? This last problem is still a vexed one, and it is only one among many, the solution of which will demand the examination of a large collection of old wall mortars, and many experiments on the properties of sand, lime, concrete, plaster, and cement. Suppose such questions provisionally settled, we find similar ones to encounter in reference to the external roofing of our walls. Shall we take slabs of stone, or wooden shingles, or slates, or tiles, or thatch, or galvanised iron, or lead, or zinc, or felt, or glass? There are special good qualities in each of them, and an Industrial Museum, by exhibiting systematically-arranged specimens of all, would furnish one important means of enabling agriculturists throughout the country to choose intelligently among them.

Again, there must be much wood-work, brick-work, and metal-work in our farm-buildings. In so far as the Agricultural and Botanical relations of timber-trees are objects of illustration in the Museum of this Society, and of the Botanic Garden, it will not be necessary to include them in any other collection within the walls of the city. There are economical relations of wood, however, of importance to the agriculturist, with the illustration or exposition of which neither the Highland Society nor the Professor of Botany charge themselves: these would fall within the scope of the Industrial Museum and the Professor of Technology. Such, for example, are the mechanical bending of trees or large boughs into shapes suitable for the knees of ships, or the girders of roofs and bridges, now practised on the large scale; the rapid drying of wood by the action of air or super-heated (*i.e.* highly heated *dry*) steam; its impregnation with chemical substances so as to season it; or to give it a colour resembling that of more costly and more highly prized woods; or to confer upon it greater hardness and solidity; or by their antiseptic and poisonous character to remove its liability

to suffer from wet-rot, dry-rot, and the invasion of fungi and insects. The derivatives of wood, also, such as bark for tanning, charcoal, tar, resin, turpentine, wood-vinegar, wood-spirit, and wood-ashes, which are all of them important as affecting the market-value of timber, would, as contents of an Industrial Museum, be indirectly of interest to the agriculturist.

Leaving wood, however, which we were looking at only in its immediate application to building purposes, without further notice, I may pass without lengthened reference over brick-work and metal-work. It would be vain to attempt showing in a brief address the interest which the agriculturist has in Fictile and Metal manufactures. Bricks for the partition-walls and garden-walls, tiles for the floors, pipes for the drains, cans for the chimneys, must all be chosen, and cannot be chosen wisely, unless opportunity is afforded for examining samples made from different clays, at different works or potteries, and fired and glazed in different ways. Of these an Industrial Museum should contain a full series, including the clays, and other materials employed in their manufacture, and in addition, of course (though that is foreign to the question of building-materials), all the long series of objects for household use or ornament which are included under earthenware, stoneware, porcelain, and china.

On metal-work similar remarks may be made. What an interest all agriculture has in the single metal Iron! Without it, how low would be the condition of British farming! Yet, in employing iron, as a substitute for wood and stone, the agriculturist must be dependent for information, in reference to its strength, safety, durability, and cheapness, on others than members of his own profession.

To finish the skeleton of our imaginary farm-building, we must consider the mode in which it shall be lighted by day, and this cannot be wisely done without a knowledge of the properties of Glass, so that the opportunity of inspecting a large series of specimens of this substance, and of learning the relative value of different kinds of it, cannot but be serviceable to every house-builder.

It thus appears that those five things alone, stone, wood, clay, metal, and glass, would, in their building relations, suffice to give the agriculturist a practical interest in an Industrial Museum and in Technological disquisitions on its contents; but if we add under clay and glass his great employment of vessels made of both, and under metals all his metallic machines and implements, from the steam-engine to the weeding-hook, it would be difficult to exaggerate the service which a full Industrial Museum and a befitting exposition of its contents would render him.

Our farm-house being completed, it will be necessary to conduct water into it. There may be choice between very soft water, like that which gathers in our Highland lochs, or water of curable hardness, like that of the English chalk districts, and some of our well-

waters, or water incurably hard, like that containing dissolved gypsum, which the deep wells of our own city and of other localities supply. The agriculturist has a direct interest in the quality of the water supplied to himself and his household, and all questions referring to that I assume to be disposed of by his Medical Attendant. He has a direct interest also in the quality of the water supplied to his cattle, and to that the veterinary surgeon will look. If both are at fault, he can fall back upon the chemical analyst, and, if a member of the Highland and Agricultural Society, may avail himself of the services of its very accomplished chemist, Professor Thomas Anderson.

Supposing the choice of water (where there is a choice) determined, we have still to settle how it shall be conveyed and stored. Should the water-pipes be of lead, or iron, or zinked iron, or tin, or gutta-percha, or glass, or porcelain, or of some other material? Are the cisterns or tanks best made of wood, or stone, or iron, or zinked iron? and how may both pipes and cisterns be prevented from the corroding action of waters of one class, and the encrusting action of waters of another? These are not fanciful difficulties. One of our large cities is still doubtful as to the propriety of bringing in a corroding soft water through lead pipes; and another contemplates the abandonment of iron pipes, because they are filled up by water of the same character; whilst galvanised or zinked iron is undergoing trial throughout the country and on shipboard, as a safe substitute for lead, alike for pipes and tanks or cisterns. Now a series of long-used water-pipes and cisterns, exhibiting the action of soft, transiently hard, and permanently hard waters, would largely assist all interested in those matters. A collection of such objects is being made for the Industrial Museum.

The water-question disposed of, there arises the not less important question of Fuel, and with it the inquiry, How shall the farmhouse and its appendages be heated and ventilated? Where there is a choice, should wood be preferred, and what kind of wood; or charcoal, and from what source; or peat, and what kind of peat; or coal, and which of the multitude of widely differing varieties of that mineral; or artificial fuel; and what are the considerations which should guide us in selecting fuel for the parlour fire, the food-boiler fire, and the furnace of the steam-engine? It should largely contribute to the practical disposal of those questions, that an extensive collection of the fuels of the world, systematically arranged with reference to their geographical and geological position, their chemical constitution, their heating and lighting power, and their economical value, could at all times be examined in the Industrial Museum, side by side with grates, stoves, and furnaces, or models and drawings of these illustrating the most approved methods of burning fuel, and of preventing or consuming smoke.

Closely allied to the question of artificial heating is that of artificial lighting. How shall the farmer most cheaply and effectively turn night into day? Will candles serve best, and, if so, what kind of candles? or oil, and what kind of oil? or will it be better to erect a gas-work on the farm, and depend mainly on gas for illumination? or is it the case that the electric light is the best and cheapest of all lights?

To answer these questions will be one important duty of the Professor of Technology, and the Industrial Museum will afford large space for the objects supplying the means of answering such queries. A collection has been commenced, which, when completed, will enable the agriculturist to judge of the relative value of candles made in whole or in part from tallow, from African palm-butter, Ceylon cocoa-nut oil, Borneo vegetable tallow, Brazilian palm-wax, and Chinese insect-wax, from the paraffine derived from the bituminous shales of the Continent, from the coals of our own country, and the peats of Ireland. A similar collection is being made of the animal, vegetable, and mineral oils, and the inflammable liquids suitable for burning in lamps, and of the materials economically available for the production of illuminating gas. Along with these will be placed lamps, models or drawings of gas-works, the apparatus for the electric light, and galvanic batteries.

Such are a very few of the ways in which Technology can in one direction assist agriculture. I have selected them as illustrative, not as exhaustive of the relation of the science of all the useful arts to the one pre-eminently useful art, Agriculture.

Nor need I enlarge upon the manufactures in which the agriculturist has a direct interest, as himself supplying the raw material for them. The consideration, for example, of the cultivated grains and roots leads directly to the manufacture of starch, sugar, alcohol, vinegar, and the arts of baking, brewing, and distilling. The cultivated grasses, along with flax, hemp, the cotton-plant, the trees yielding jute, and other textile fibres, involve the arts of spinning, weaving, bleaching, dyeing, calico-printing, and beyond these the arts of paper-making, letterpress-printing, engraving, lithography, and many more.

In connection with animals, putting aside their immediate use as food, and the value of the manures derived from them, we have the application of their skins in the manufacture of leather, parchment, vellum, glue, size, and gelatine; the application of their horns and hooves to the manufacture of combs, spoons, cups, and the like; the application of their bones to similar manufactures, and also in the production of hartshorn, ivory-black, and phosphorus; and the application of their blood and offal, when not otherwise employed, to the manufacture of prussiate of potash, prussian blue, and other dyes and pigments, and to the artificial

production of nitre. Having an eye also to the agriculture of the world, I refer, in as many words, to the important insect derivatives, honey, wax, silk, shell-lac, cochineal, and carmine, and to the arts to which they minister.

All the trades, arts, and manufactures referred to are based upon the cultivation of the soil. As the money-profit of agriculture must largely depend upon the value of the products which it directly or indirectly furnishes to the markets of the world, the farmer plainly has a deep interest in the uses to which his produce is put by the followers of other callings, and these uses he can nowhere so intelligently learn as in an Industrial Museum.

Farther, the cost of producing a cart of hay, a waggon-load of turnips, a sack of wheat, a Christmas turkey, a well-fed lamb, or a fat ox, varies of necessity with the cost of the materials required for its production. Now, these materials are in demand for the production of other commodities, and the agriculturist has an interest in knowing what these commodities and who their producers are. Let me illustrate this by an example or two.

The bones of animals have a high agricultural, and therefore a high commercial value. The farmer of Great Britain would be glad to have all the dead animal bones in the world at his disposal. But in the bone-market he must purchase against many competitors. The price of bones is raised against him by

Firstly, The ivory-turner, who converts them into spoons, brush-handles, buttons, and ornaments.

Secondly, The glue-maker, size-maker, or jelly-maker, who extracts their gelatine from them.

Thirdly, The sugar-refiner, who requires them for the ivory-black with which he bleaches his syrup.

Fourthly, The refiner of metals and assayer of gold and silver, who finds the powder of calcined bones superior to everything else as a material for his *cupels*, those peculiar cups and basins in which precious metals, and especially silver, are separated in the furnace from the common metals, such as lead and copper.

Fifthly, The manufacturer of porcelain, who has long ago discovered that calcined bones greatly improve the quality of china, so that in Staffordshire they find their way to the potter much more readily than to the farmer.

Sixthly, The lucifer-match maker, who employs bones to yield phosphorus, and whose manufacture, insignificant though it may appear to be, is sufficient, in England alone, to divert shiploads of bones from the farmer.

Seventhly, The pharmaceutical chemist, who prepares from bones, phosphoric acid, phosphate of soda, and the other phosphates used in medicine.

Here are seven competitors in bone-buying against the farmer. A great extension of any of their trades must raise the cost of

bones to all who employ them. The abandonment of the use of bones in favour of some other raw material by any of those trades, would lessen their cost to all the others. The discovery of a source of phosphates other than bones would equally lessen the competition for them. The farmer has thus an interest in watching the doings of the ivory-turner, glue-maker, sugar-refiner, metal-refiner, porcelain manufacturer, lucifer-match maker, and pharmaceutical chemist; and the systematically-arranged bone products of a Technological Museum, would largely furnish him with the means of observing the development of rival professions.

Again, there are patents enrolled for distilling ammonia from guano, which at present are not turned to account because guano is too dear, but if its price fell, they would at once come into operation. The farmer has thus a direct interest in encouraging the production of ammonia from other substances than guano,—as, for example, from gas-liquor, which is of less value to the farmer than the manure in question, but which, nevertheless, as I think Dr Anderson has already pointed out to the Society, is at present in many quarters used by nobody, being literally thrown away from the smaller gas-works in the country.

Again, nitrate of soda is *comparatively* cheap, because from its tendency to absorb moisture, and its slower evolution of oxygen when melted, it cannot be used as a substitute for nitrate of potash in the manufacture of gunpowder; but it serves better than nitrate of potash for the preparation of nitric acid; and everything therefore that leads to the increased consumption of this acid, will raise the price of nitrate of soda for the farmer. Further, in a time of war like the present, when gunpowder is costly and in great demand, it is worth while to convert nitrate of soda into nitrate of potash; and a few weeks only have passed since an Order in Council put a stop to the exportation, as contraband of war, of certain apparently innocent potash-salts extracted from kelp, which Government had discovered were employed on the Continent to convert nitrate of soda into nitrate of potash for Russian gunpowder. Thus the cost of gunpowder and of nitric acid affects the value of one of the most highly-prized fertilisers in use among agriculturists.

Once more: it might seem, at first sight, as if the agriculturist had no very special interest in the price of sulphuric acid. But how does the case stand? Sulphuric acid is prepared from sulphur, and all our sulphur comes from Sicily. Political changes, or the fortunes of war, may any day cut us off, as they have done before, from Etna as a source of sulphur. In that case the farmer would immediately experience an increase in the cost of all the articles—and they are very numerous—in the manufacture of which sulphuric acid is employed. Thus, super-phosphate of lime, sulphate of ammonia, sulphate of soda, sulphate of magnesia, and all the other

sulphates used as fertilisers, except perhaps sulphate of lime, would at once rise in value. So would washing-soda and soap, and with them all bleached and dyed goods, for bleaching and drying would be more expensive. So would glass, vinegar, spirit of salt, ether, chloroform, and many less important but yet useful substances which require sulphuric acid for their production.

The evils I am referring to were partially experienced some twenty years ago, and led in part to the substitution of iron pyrites (the bi-sulphuret of iron) for sulphur as a source of sulphuric acid. A recurrence of these evils is apprehended, and I have very recently sent to an intelligent inhabitant of Iceland the results of an examination of its volcanic sulphur, which may yet come into competition with the sulphur from Sicily. It would not then be waste of time for an intelligent farmer to study in the Industrial Museum all the Technological relations of sulphur, for he has plainly an interest in its sources being multiplied, and its products or derivatives being cheapened.

On the direct relation of Technology to agriculture I will say no more; but allow me a few words on their indirect relation to each other. Hitherto I have spoken as if the sole question for consideration were, how the single farmer could be made a wealthier and more comfortable person; but I know that I should do the greatest injustice to the Society of which I have long been a member, if I addressed my fellow-members as actuated only, or even largely, by a selfish, utilitarian spirit. I know, on the other hand, that these and the other meetings of this Society are rallying-points for all those Scottish agriculturists who love their profession as a profession, who are actuated by a high *esprit de corps*, and who seek to improve not only their own farm, or their own parish, or their own shire, but the whole country, and through it the entire world.

The recent munificent free-will gift of the Agricultural Statistics of Scotland to all the competing nations of the globe, is proof sufficient of the generous spirit in which this Society encourages useful knowledge: but I recall also the project warmly entertained by this Society some years ago, and not yet, I presume, abandoned, of elevating the standard of education among the younger members of the agricultural profession, by giving its diploma as a certificate of merit to all who should pass creditably an examination, after some two years of study in such branches as Botany, Chemistry, Veterinary Science, Mechanical Science, and one year's work on a farm.

Without obtruding my opinion on the advisability of such a project being carried out, I refer to it now, because the same feeling which led to its entertainment, will lead to the encouragement of Technology and the Industrial Museum.

It cannot but be of service to a young man about to follow the profession of agriculture, to have the means of studying the sources,

the objects, the processes, and the products of all the other manufactures of the country. It cannot but sharpen and strengthen the very faculties which will be most needed in his own calling. It cannot but expand his mind and quicken his sympathies, to possess an intelligent appreciation of the learning, patience, perseverance, faith, courage, ingenuity, inventive skill, and manipulative dexterity which have made other professions great and famous, and which, transferred to his own profession, will make it greater and more famous than it is. And apart from this, are not such arts as photography and the electrotype; such devices as the electric telegraph, the electric light, and the time-ball; such machines as the railway locomotive, the screw-propeller, and the steam-hammer, besides a hundred others, worth the study of all who wish to realise what a wonderful worker, with all his defects, Man is?

For those reasons, and for many more which I do not particularise, I ask you, if you acknowledge any justice in what I have said, to look with favour on the Industrial Museum.

That Museum is budding into existence, and additions are daily made to it; but I have at my disposal, for its contents, no fit accommodation. There is room enough, no doubt, within the walls of the Trades Maiden Hospital, and under the roof of Argyle Square Chapel, but these are only suitable as receiving-houses, and the latter building must be taken down as soon as the erection of the new Museum is commenced; so that, unless its erection is to be very long delayed, it would be folly to fill the chapel with specimens. Little good can be done till proper galleries are provided. These are imperatively demanded by the present condition of all the museums in Edinburgh. Within the walls of the University, a very large number of important objects of natural history are, from sheer want of space to exhibit them, shut up from view in boxes. The Professor of Anatomy has almost ceased to expend money in adding to the splendid collection of Comparative Anatomy (most important in reference to geology) which he has accumulated. There exists at present no building in our city where either resident or stranger can practically acquaint himself with the geology and mineralogy of the country. The Museum at the Botanic Garden is already straitened for room, and this Society's Museum is in the same case.

It is, accordingly, with no selfish or restricted object in view that I urge the desirableness of encouraging the erection of the proposed new Museum. I have no reason to think that Government would grudge the sum, if aware of the pressing necessity for its expenditure. All the money that is required would not sensibly increase the year's estimates of the Commons, or tell upon the sufficiency of the military chest. We cannot, however, expect money to be granted unless we ask for it; and I have heard but two arguments against asking a grant.

The one is, that a war-time, with doubled income-tax, and the prices of all commodities raised, is not the period when grants of public money should be asked for peaceful undertakings which are not imperative.

Now, if the sum of money needed for the Museum, would, by its diversion from our army and navy, appreciably lessen our power to fight effectually the just battle of our country, then it would be most culpable and cowardly to ask for it; but no well-informed person imagines that a grant of £10,000 or £20,000 a-year till the Museum be completed, would cripple our fleets and armies, or exhaust the resources of our Treasury. This argument, therefore, I put aside.

The other is, that the public mind is so occupied with the events of the war, that it is idle to expect the mass of the community to be interested in the prosperity of such an institution as an Industrial Museum. This conclusion I believe to be the very opposite of a true one. Just because we are at war, are we likely to excel in peaceful pursuits. The excitement occasioned by intense sympathy with our brethren in arms, and continually fostered by news from the battle-field, compels us to active thought and work; and the activity which cannot expend itself in bloody combat, is expended on peaceful labour.

A civilised people fighting of its own free-will for a cause which commends itself to its heart and conscience, will carry into all its acts, so far as it can, the courage, energy, sagacity, and devotion which are the pre-eminent virtues of the soldier and the sailor. It is as much in keeping with one great natural law, that the industrial arts of peace should flourish at home, because the destructive arts of war flourish abroad, as it was in keeping with another great natural law, that the snowdrops and violets which last spring so quickly covered the fields of Alma and Balaklava, were richer in colour, and sweeter in fragrance, because their roots were watered with the precious blood of the slain. All history shows that a season of international conflict is a season of intellectual activity, and that, whatever be the evils of war, intellectual work of all kinds goes on well at such a time. Moreover, the close of a war, however successful, must be followed by a reaction of disappointment, and a season of political discontent. We should be prepared, when peace comes, not to ask for money, and to begin building a Museum, but to throw open a more or less fully equipped one, as a School of Instruction for those whose warlike occupations will then be gone, and a place where all may learn the arts of peace.

REAPING-MACHINES.

The following Tables, with the relative remarks appended, embody the substance of notes, carefully kept by Mr Hunter of Thurston, respecting the comparative cost of cutting crops by machines and by hand, on the farms of Thurston and Woodhall.

The total acreage was 460⅝ imperial, comprising 157 acres of white crop, 12½ of beans, and 49½ of hay cut by machines, and 241⅝ of white crop cut by the hand. There was an additional extent of crop which is not included, because, having been cut partly by machine and partly by hand, and no separate account of expense having been kept, it is not available for comparison.

A pair of horses, including the driver, is charged at the rate of 8s., and the steerer at 2s. 6d. per day; but the wages of the latter are stated only for the hours he was actually engaged, because, if a machine went out of order, he was sent to other work. The horses and driver, however, are charged for the whole yoking, even although the machine may have stopped.

Labourers are charged at 2s. 6d., shearers at 2s., 1s. 8d., and 1s. 4d., and youngsters at 1s., 10d., and 8d. per day. These rates, however, do not include food.

MACHINE-CUTTING.

Crops cut by Machines.	No. of Field.	Imperial Acres.	Hours at work with Machines.	Days of Horses Charged.	Expense of Machines.	Expense of Gathering and Stooking after Machines.	Total Expense.	Average Expense per Acre.
					£ s. d.	£ s. d.	£ s. d.	s. d.
Wheat,	1	13½	23	2	2 2 0	4 6 10	6 8 10	9 6½
Oats,	2	12¼	30	5½	4 6 0	6 6 1½	10 12 1½	17 3¾
Oats,	3	25¼	36	3½	3 3 0	7 1 3	10 4 3	8 1
Oats,	4	71	74½	8	8 1 6	17 14 3	25 15 9	7 3
Oats,	5	35	46	4½	4 16 0	8 14 3	13 10 3	7 8½
Beans,	6	12½	30½	4½	3 3 0	2 14 3	5 17 3	9 4½
Hay,	7	19½	33¼	5	2 18 4	...	2 18 4	3 1
Hay,	8	30	31½	4	3 10 8	...	3 10 8	2 4¼

HAND-CUTTING.

Crops cut by Shearers.	No. of Field.	Imperial Acres.		Total Expense, including Binding and Stooking.	Average Expense per Acre.
				£ s. d.	s. d.
Wheat,	1	9	....	4 8 3	9 9¾
Barley,	2	56½	....	26 13 0	9 5¼
Oats,	3	8	....	5 4 3	13 0¼
Oats,	4	12¼	....	5 9 3	8 11
Oats,	5	32¼	....	14 1 9	8 8½
Barley and Oats,	6	24½	....	12 13 0	10 3¾
Barley and Oats,	7	99¼	....	47 15 4	9 7½

Averages.

White crop cut by machine, . .	£0	8	5¾	per imperial acre.
Do. cut by hand, . . .	0	9	7½	per do.

REMARKS.

1.—*Fields Cut by Machines.*

Field No. 1. Very strong crop of wheat, and very much laid; obliged to cut one way at an angle up the hill and across the ridges.
" No. 2. Very heavy crop of oats, much laid, and only able to cut up-hill.
" No. 3. Only able to cut one way.
" No. 4. This field cut both ways, except for a few hours one morning, when the wind would not allow the web to deliver, but blew the cut corn over the top of the machines.
" No. 5. Part of this field a very heavy crop of oats; able to cut about half of it both ways; the remainder, some cut up-hill, and some across the face and across the ridges.
" No. 6. Very heavy crop of beans; some stalks measured 6 feet 9 inches, average about 5 feet 6 inches; cut south end of field up the hill; the north end down the hill, at one angle across the drills.
" No. 7. Could only cut one way, up-hill, returning empty.
" No. 8. Could only cut one way, up-hill, except about 5 acres cut both ways.

2.—*Fields Cut by Hand.*

Field No. 1. Too much laid and twisted for machines.
" No. 2. Fine level field for machines, but too much twisted.
" No. 3. Crop too much twisted for machines.
" No. 4. Very heavy crop of oats, and mossy field; did not try the machines, as they were at work in No. 4, above.
" No. 5. Too steep and hilly for machines.
" No. 6. The barley very much laid and twisted, machines therefore not tried. The oats a fine standing crop, but let the shearers cut, as the machines were working elsewhere.
" No. 7. Much too steep for machines.

PROCEEDINGS IN THE LABORATORY.

By Professor Anderson, M.D., Chemist to the Society.

EXPERIMENTS WITH SPECIAL MANURES.

The question of the relative value of nitrate of soda, sulphate of ammonia, and Peruvian guano, as top-dressings for grass and grain crops, has become so important as to demand repeated experiments of greater precision, and more completely comparable with each other, than any which have yet been made. With the view of adding something to the facts at present known, the Directors of the Highland and Agricultural Society early last spring requested Mr Porter, Monymusk, and Mr M'Laren, Millhill, to institute such experiments, and I was directed to prepare a scheme for the purpose, so that uniformity might be secured. In addition to the manures already named, I suggested the propriety of making some experiments with the muriate of potash, partly with the view of ascertaining the value of potash as a manure—a point on which we are almost entirely without definite information—but more especially for the purpose of putting to the test of experiment a view which, though not absolutely new, has been recently very explicitly expressed regarding the cause of clover sickness. It has been asserted that the failure of the clover crop is due to a deficiency of potash in the soil, and that, when too frequently repeated, it refuses to grow, because the previous crops had completely exhausted the supply of that alkali. If this view be correct, it seemed a reasonable inference that potash should always act beneficially on the clover; and as the muriate can be obtained in commerce in a state of very great purity and at a moderate price, it was selected for the experiments.

In arranging the conditions of the experiments, it seemed most desirable that the quantity of each substance to be used should not be absolutely fixed, as there are many circumstances which render it necessary to modify the amount of the application in different districts. In this respect a perfect latitude was given to the experimenters; it was only stipulated that the quantities of the different manures should bear a definite relation to one another; and the relative weights of the first three manures were fixed, so that they should all supply the same amount of nitrogen. For this purpose nitrate of soda was selected as the standard, and a Table was constructed giving the number of pounds of sulphate of ammonia and Peruvian guano, containing the same quantity of nitrogen as a hundredweight of the nitrate. The quantity of muriate of potash was fixed by reference to the chemical *equivalent* of potash. The proportions were—

Nitrate of soda,	112 lb.
Sulphate of ammonia,	87 „
Peruvian guano,	134 „
Muriate of potash,	103 „

The experimenter having resolved upon the quantity of nitrate of soda he intended to employ, was to use all the other substances in the proportions indicated in the Table. The manures employed in the experiments were all genuine and of excellent quality. The muriate of potash was a very pure article; it contained between 5 and 6 per cent of moisture, and only a trace of sulphate of potash; and the quantity of potash corresponded to 93 per cent of the muriate of potash.

To the reports of Mr Porter and Mr M'Laren I have added another series of interesting experiments made in an exactly similar manner by Mr Dove of Ecclesnewton.

I.—Experiments at Monymusk.

1. *On White Wheat.*—The field on which this experiment was made is composed of light alluvial soil, or haugh land; on a dry open subsoil of sand and gravel. It was ploughed from four-year-old lea in October 1854, and sown with wheat at the rate of 4 bushels per acre. On the 8th May 1855, the different manures were sown over it from the hand—the weather then being moist and showery. The wheat was cut on the 25th September, stacked on 5th, and thrashed on 24th October, when the produce of one acre in each plot was found to be as under:—

No. of Plots.	Description of Manures.	Quantities of Manures.	Cost of Manures.			Weight of Straw.				Quantities of Wheat.			Weight of Wheat per bushel.	Increase of grain per acre compared to No. 3.		Decrease of grain per acre compared to No. 3.		Increase of straw per acre compared to No. 3.		
		lb.	L.	s.	d.	tons.	cwt.	qrs.	lb.	qrs.	bush.	pks.	lb.	bush.	pks.	bush.	pks.	cwt.	qrs.	lb.
1	Nitrate of Soda, .	187¼	1	18	5	2	7	1	13	3	17	1	59	1	1	..	..	..	..	20
2	Sulphate of Ammonia,	145½	1	3	4½	2	12	3	7	4	1	3	58½	3	3	..	..	5	2	14
3	No Manures, . .	..		..		2	7	0	21	3	6	0	60¾	..		..	..	..	..	..
4	Peruvian Guano, .	224	1	4	0	2	11	3	14	3	4	3	60½	..		1	1	4	2	21
5	Muriate of Potash, .	172¼	1	3	0	2	6	1	25	3	3	2	61½	..		2	2	..	..	..

The wheat was rather damp when thrashed out, which may in some degree account for its lightness in weight.

2. *On New Grass for Hay.*—This field is as nearly as possible of the same kind of soil as the last. The grass seeds were sown down with a crop of bere in April 1854, and consisted of a mixture of perennial rye-grass with common red and white clover. The manures were sown from the hand on the 8th May 1855; the weather at the time was soft and showery. The hay was cut on 26th July, coled 31st July, and again on 6th August. It was tramp-coled and weighed on 16th August, when the result per acre was as follows:—

No. of Plots.	Description of Manures.	Quantities of Manures.	Cost of Manures.			Quantity of Hay per Acre.				Increase of Crop compared to No. 3.		
		lb.	£	s.	d.	tons.	cwt.	qrs.	lb.	cwt.	qrs.	lb.
1	Nitrate of Soda, . .	187¼	1	18	5	1	5	2	14	9	3	18
2	Sulphate of Ammonia, .	145½	1	3	4½	1	6	2	7	10	3	11
3	No Manure, . .	...	0	0	0	0	15	2	24	...	...	
4	Peruvian Guano, . .	224	1	4	0	1	10	0	0	14	1	4
5	Muriate of Potash, .	172¼	1	3	0	0	19	3	0	4	0	4

During the months of May and June the weather was unusually dry, which in so far accounts for the lightness of the crop.

3. *On Irish Cup Potatoes.*—This experiment was tried on light black moorland soil, on a subsoil of poor gravelly clay. The potatoes were planted on 2d May, with 20 cubic yards of well-made farmyard dung per acre. The manures were sown on the drills on the 5th June, and hoed into the soil immediately thereafter. The potatoes were holed on the 16th October, when the weight per acre was found to be as under:—

No. of Plots.	Description of Manures.	Quantities of Manures.	Cost of Manures.			Quantity of Potatoes per Acre.				Increase of Crop compared to No. 3.			Decrease of Crop compared to No. 3.		
		lb.	£	s.	d.	ton.	cwt.	qrs.	lb.	cwt.	qrs.	lb.	cwt.	qrs.	lb.
1	Nitrate of Soda, .	187¼	1	18	5	7	5	2	0	...	...		2	2	0
2	Sulphate of Ammonia,	145½	1	3	4½	7	4	2	0	...	...		3	2	0
3	No Manure, . .	...	...	...		7	8	0	0	...	...		...	...	
4	Peruvian Guano, .	224	1	4	0	8	4	0	0	12	0	0	...	...	
5	Muriate of Potash, .	172¼	1	3	0	8	6	2	0	18	2	0	...	...	

The whole of the produce of each plot was weighed on the steelyard, and in every way these experiments have received my best attention.

JAMES PORTER.

MONYMUSK, 14*th November* 1855.

II.—Experiments at Millhill.

Sir,—Herewith I send you a set of three Tables, containing the results of trials of the various manures you were kind enough to intrust me with. I only say, in return for this trust, I have done all that was in my power to make the trials as perfect as possible; all the measurements and weighings being done under my own eye, and, where possible, with my own hands. Whatever, therefore, may appear strange in any of the results, I leave to Dr Anderson to give a reason for. You are aware the quantities I was bound to adhere to as a basis of operations were:—

Nitrate of soda, ...	112 lb.
Muriate of potash, ...	103 „
Sulphate of ammonia, ...	87 „
Peruvian guano, ...	134 „

Any other rate I might think right to apply I had the liberty to do so, only keeping the same proportions. Not having a very high opinion of the very small quantity recommended by some, I doubled the quantities of the whole four manures, bringing them thus nearer our usual applications. Indeed, as you will see, the smaller quantities had no effect whatever on the wheat. But in my opinion this was not a very favourable season for top-dressing, especially with guano. This on wheat did no good, while on grass, with its moister bottom, it proved by far the highest and truest dressing, retaining its effect during the growth; and I shall watch and see if it has any effect on the oat crop.

The nitrate of soda and sulphate of ammonia appeared first to the eye by the darker green of the leaves of wheat and grass, and they seemed to act most on the rye-grass. The muriate of potash turned the leaves brown, or burnt, at first. This went off after rain. This was by far the most successful application to the potatoes,—indeed, as you will see by the Table, the others did nothing as a crop, while the potash sent out a flush of shaws, and gave a crop equal to the other parts of the field, which was heavily dunged; indeed, the shaws kept longer green and freer from spots than any we had. I was rather surprised to find the lesser quantities prove highest, more especially the guano; but the potato-field was not so equal as I would have liked to try an experiment on, as, from its being late in the season before I had your letter, I had only that piece left unplanted, and so had to use it.

The nitrate of soda and sulphate of ammonia I used, I had from Wm. Baily, Edinburgh; the Peruvian guano from S. C. Thomson, Dundee, being part of a cargo Dr Anderson analysed and

found very good; the muriate of potash was sent by Mr Paterson, Glasgow.

I have the honour to be, &c.

JOHN M'LAREN.

To John Hall Maxwell, Esq.

P.S.—I had nearly forgot to mention that what induced me to continue the experiments on the second crop of grass was, that I had often seen, especially after any of the stimulating applications to young grass, a heavy cut of hay followed by a corresponding short cut of second crop. Guano here proved itself a true manure. J. M.

1. *Wheat.*

Manures applied 1st May and cut 8th September. Thrashed 1st October 1855. Soil, a deep loam in good condition, after beans, well manured.

No.	Kinds of Dressing.	Quantity per Imperial Acre.	Produce in Wheat.	Produce in Straw.	
		lb.	bush.	cwt.	lb.
1	Nitrate of Soda, . .	224	$45\frac{1}{3}$	36	88
2	Muriate of Potash, . .	206	$44\frac{1}{3}$	35	80
3	Sulphate of Ammonia, .	174	44	34	32
4	Peruvian Guano, . .	268	$39\frac{1}{12}$	35	20
5	Nitrate of Soda, . .	112	$39\frac{3}{4}$	33	24
6	Muriate of Potash, . .	103	$39\frac{1}{12}$	31	48
7	Sulphate of Ammonia, .	87	$37\frac{1}{12}$	28	64
8	Peruvian Guano, . .	134	$36\frac{3}{4}$	28	84

Fenton wheat, drilled in autumn and twice hoed.

2. *Potatoes.*

Planted 22d April, and manures applied after a light covering of earth was put over the sets, and just before they appeared above this, when they were fully earthed up 13th May. Soil, a light loam, rather poor after lea oats. Potatoes of the hen's nest variety, taken up 12th October 1855.

No.	Kinds of Dressing.	Per Acre.	Produce per Imperial Acre.		
		lb.	tons.	cwts.	lb.
1	Nitrate of Soda, . .	224	4	7	56
2	Muriate of Potash, . .	206	7	3	64
3	Sulphate of Ammonia, .	174	3	2	16
4	Peruvian Guano, . .	268	3	5	80
5	Nitrate of Soda, . .	112	4	15	40
6	Muriate of Potash, . .	103	8	—	—
7	Sulphate of Ammonia .	87	2	16	48
8	Peruvian Guano, . .	134	4	3	24

3. *Grass for Hay.*

Manures applied 2d May 1855, on light clay soil in good condition, after a good crop of barley. Cut and weighed green 7th July. Weighed as hay, and stacked 11th July.

No.	Kinds of Dressing.	Quantity per Acre.	Weight when Cut.			Weight when Hay.			Weight of Second Crop, 10th Oct.		
		lb.	tons.	cwts.	lb.	tons.	cwts.	lb.	tons.	cwts.	lb.
1	Nitrate of Soda,	224	6	11	48	2	16	32	6	9	64
2	Muriate of Potash,	206	6	9	64	2	6	32	7	18	32
3	Sulphate of Ammonia,	174	7	7	28	3	1	16	7	0	16
4	Peruvian Guano,	268	7	11	16	3	2	32	9	4	0
5	Nitrate of Soda,	112	6	4	64	2	10	96	6	13	16
6	Muriate of Potash,	103	5	9	80	2	2	0	7	6	16
7	Sulphate of Ammonia,	87	6	1	48	2	10	32	6	13	80
8	Peruvian Guano,	134	6	6	64	2	11	16	7	17	64
	Nothing,	—	5	17	16	2	7	16	8	5	32

III.—Experiments at Eccles-Newton.

1. *Oats.*

Manures applied on 4th April, and harrowed in along with the Seed.

No.	Manures per Acre.	Produce of Good Corn.		Produce of Light Corn.	Weight of Good Corn per bushel.	Weight of Light Corn per bushel.	Weight of Straw and Chaff.
		bush.	lb.	bush.	lb.	lb.	
1	112 lb. of Nitrate of Soda,	43	21	5	41½	34	...
2	87 lb. Sulphate of Ammonia,	41	0	6	42	34	...
3	137 lb. Guano,	40	16	6	41	34	...
4	37 lb. Nitrate of Soda, 29 lb. Sulphate of Ammonia 46 lb. Guano,	41	0	4½	42	34	...
5	Nothing,	39	0	5	42	34	...

2. *Wheat.*

Manures applied on 26th April. The Crop cut on 28th August. Thrashed and Weighed on 19th September.

No.	Manures per Acre.	Produce of Good Wheat.		Produce of Light Wheat.		Weight of Good Wheat per bushel.	Weight of Light Wheat per bushel.	Weight of Straw and Chaff.	
		bush.	lb.	bush.	lb.	lb.	lb.	stone.	lb.
1	Nothing,	30	44	3	17	57	49	229	14
2	112 lb. Nitrate of Soda,	29	0	4	42	56	49	274	0
3	87 lb. Sulphate of Ammonia,	28	34	4	30	55	49	263	2
4	137 lb. Guano,	29	28	4	26	56½	49	259	10
5	37 lb. Nitrate of Soda, 29 lb. Sulphate of Ammonia 46 lb. Guano,	27	0	4	0	56½	49	240	20
6	103 lb. Muriate of Potash,	29	17	4	25	58	49	238	0

3. *Wheat.*

Manures applied on 27th April. The Crop cut on 25th August. Thrashed and Weighed on 26th September.

No.	Manures per Acre.	Produce of Good Wheat.		Produce of Light Wheat.		Weight of Good Wheat per bushel.	Weight of Light Wheat per bushel.	Weight of Straw and Chaff.	
		bush.	lb.	bush.	lb.	lb.	lb.	stone.	lb.
1	Nothing, ...	30	57	1	17	61	54	199	17
2	112 lb. Nitrate of Soda, .	36	20	1	12	59	54	240	7
3	87 lb. Sulphate of Ammonia,	36	18	1	37	59	54	217	3
4	137 lb. Guano, ...	33	39	1	9	59	54	205	17
5	37 lb. Nitrate of Soda, 29 lb. Sulphate of Ammonia 46 lb. Guano, . . .	33	56	1	1	59	54	210	10
6	103 lb. Muriate of Potash,	28	42	0	22	61	54	170	4

4. *Young Grass.*

Manures applied 7th May. Crop cut 6th July. Weighed 14th August.

No.	Manures per Acre.	Produce of Hay per acre.	
		stone.	lb.
1	Nothing, ...	190	20
2	112 lb. Nitrate of Soda, ...	194	16
3	87 lb. Sulphate of Ammonia, ...	207	10
4	137 lb. Guano, ...	192	4
5	37 lb. Nitrate of Soda, ... 29 lb. Sulphate of Ammonia, ... 46 lb. of Guano, ...	196	4

5. *Young Grass.*

Manures applied on 7th May. Crop cut 3d July. Weighed 11th August.

No.	Manures per Acre.	Produce of Hay per acre.	
		stone.	lb.
1	Nothing, ...	99	6
2	112 lb. Nitrate of Soda, ...	129	18
3	87 lb. Sulphate of Ammonia, ...	124	16
4	137 lb. Guano, ...	127	6
5	37 lb. Nitrate of Soda, ... 29 lb. Sulphate of Ammonia, ... 46 lb. Guano, ...	132	8

6. *Young Grass.*

Manures applied, one-half on 7th May, the other on 11th May. Crop cut 3d July. Weighed 11th August.

No.	Manures per Acre.	Produce of Hay per acre.
		stone. lb.
1	Nothing, ...	127 20
2	224 lb. Nitrate of Soda, ...	140 0
3	174 lb. Sulphate of Ammonia, ...	126 14
4	274 lb. Guano, ...	133 0
5	74 lb. Nitrate of Soda, ... 58 lb. Sulphate of Ammonia, ... 92 lb. Guano, ...	149 14

Remarks.—No. 1 was made on a piece of light dry turnip soil of pretty good quality; the weather was very dry when it was sown, and continued so till the 7th of May, when we had a few days showery. They all brairded very well, and I never could see any difference in their appearance. The crop was all laid early, and when cut was nearly as flat as if a roller had passed over it.

No. 2 was made a winter wheat after summer fallow, on a piece of good loamy clay, new drained, and limed with 40 bolls of lime per acre, and sown with 4 cwt. of rape-dust in the autumn. For many years past it had been so ill farmed and exhausted, and the crop so very bad, that I did not think the first crop after improving it would have been so strong, else I would not have experimented on it; as it was, the crop was far too strong, and was laid when in bloom, and never rose again.

No. 3 was made on winter wheat after beans, and sown with 4 cwt. of rape-dust in the autumn, on a piece of strongish clay soil; it had not been limed for seventeen years, but was in fair condition. It was a fair crop, and stood up very well,—there was hardly a laid stalk in it; though pretty uniform in quality, the land gets rather weaker as you go from No. 1 to No. 6, and I think there might have been the same difference between them had no dressings been applied: so I conclude that muriate of potash had no effect whatever.

No. 4 was made on a piece of rather strong clay soil in good condition. Limed eighteen years ago, the grass was very well and equally planted—not a blank in it—consisting nearly altogether of red clover, with a very small mixture of perennial rye-grass. The weather all through April was so very dry that I could not apply the manures so soon as I wished; after they were applied, we had a few days of showery weather, and they got pretty well washed in. They told rapidly on the appearance of the crop,

and, judging by the eye at the time of cutting, I thought there would be from 30 to 40 stones per acre more on the dressed lots than on the undressed ones, and I was much surprised to find the difference so small when weighed. The weather was very unfavourable for hay-making at the time; the experiments were exposed to the whole of it, and the hay was much damaged.

Nos. 5 and 6 were on the same field, good clay soil, not heavy. It had not been limed for forty years, and was in poor condition. No. 5 was on grass after barley, and 6 after spring wheat. It was not very well planted, and consisted of more rye-grass than clover. In No. 5 the lot that got nothing was better planted with clover than the others. I did not observe the difference at the time of sowing, but at cutting it was evident it was nearest the fence, and had perhaps benefited by the shelter from the cold spring winds. A few ridges between it and the ledge, dressed to nearly the same expense as the others, produced 160 stones per acre. I intend to follow out the results of this experiment on the oat crop next season.

The results of these experiments present many points of much interest. They illustrate particularly the danger of drawing absolute conclusions from a limited number of trials, for we see that there is far from being perfect correspondence, although the quantities in all cases were so adjusted as to admit of an easy comparison. In fact, there are individual instances, in which some of the substances of which the manurial effects are too well known to admit of question, appear to have produced a decrease in place of an increase in the produce, but in these cases the diminution is generally small, and is no doubt to be attributed to trifling variations of the soil. The results generally are far from maintaining the alleged superiority of nitrate of soda; and though they assign to it a position nearly parallel to that of sulphate of ammonia, both contrast rather unfavourably with guano. In its action upon grass, generally considered to be the crop to which nitrate of soda can be most advantageously applied, this is very conspicuous from Mr Porter's experiments, in which it gives almost exactly the same increase as the sulphate of ammonia; and Mr M'Laren's and Mr Dove's, though presenting less uniformity, give results which, on the whole, point in the same direction. On the other hand, the superiority of guano is particularly evident, both from Mr Porter's and Mr M'Laren's experiments—the former obtaining by its use a produce exceeding that from nitrate of soda by almost exactly a fifth, and the latter by nearly a sixth. Mr M'Laren's experiments have the additional importance of showing the greater slowness and permanence of action of guano, which appears to have produced upon the second crop of hay a considerably greater effect than it did upon the first. The conclusion to which we are thus brought is in perfect

accordance with theory, for it is to be observed that the manures employed were taken so as to supply the same quantity of nitrogen, irrespective of their other constituents; and so long as their effect is dependent upon that substance alone, it seems to be immaterial whether it be in the state of ammonia or nitric acid. But Peruvian guano produces a greater manurial effect, because it supplies phosphates and alkaline salts in addition to nitrogen, and hence its composition justifies the title of a "true manure," applied to it by Mr M'Laren.

When we examine the effects of these substances on wheat, the results are materially different, and here guano almost invariably proves inferior either to nitrate of soda or sulphate of ammonia. In Mr Porter's experiment it even gives somewhat less than the unmanured portion; and the same result is also obtained in one of Mr Dove's experiments, where, oddly enough, *all* the manures give a smaller produce than the unmanured portion. If we set aside this experiment, which we are justified in doing by the anomalous nature of the results, we find that guano, although producing a decided increase, never equals the other two manures. In Mr Porter's experiments sulphate of ammonia greatly exceeds even nitrate of soda, but in all the others the latter proves the best. In estimating the relative values of these manures, it is necessary to bear in mind the remark made by Mr M'Laren, that the season was unfavourable to the use of top-dressings, having been unusually dry. And this must have acted more to the disadvantage of guano than of the other manures, because from the less degree of solubility of its constituents it is more slowly and imperfectly incorporated with the soil than the highly soluble sulphate of ammonia and nitrate of soda, which are readily washed down by even a very trifling shower. To render these experiments complete, the produce obtained from the same plots during the coming season ought also to be determined; for it has been found in some cases that, where a larger produce has been obtained by the use of a special manure during one season, there has been a corresponding decrease the next,—and the extension of the experiment in this way is really a matter of very considerable moment in drawing trustworthy conclusions. In the case of nitrate of soda and sulphate of ammonia, where the effect produced is dependent entirely on the nitrogen, we should expect that it would be exhausted during the first season; and though a small quantity of ammonia might be retained by virtue of the absorbent powers of soils, this would not apply to the nitric acid of the nitrate, which, so far as we know, the soil has not the power of absorbing and retaining. With guano a greater permanence of effect is to be anticipated, for it acts more slowly, and a considerable quantity of its phosphates, and probably some ammonia, are likely to be retained in the soil, and become available to the subsequent crop.

The muriate of potash has given results of singular importance, though very different from those which were anticipated. On the hay crop its effect has been quite unimportant; nor can any conclusion be deduced from the experiments on wheat, the results of which are diametrically opposed to each other. But for the potato it has proved a manure of extraordinary value, and in Mr Porter's hand has produced a decided, and in Mr M'Laren's a very remarkable, increase in the produce. While I am far from anticipating that results of so unequivocal a character will always be obtained, it is obvious that there is great reason to desire a further extension of experiments with this substance. Should they be undertaken, it would be well that the sulphate of potash should also be employed, as it can be obtained at a considerable lower price; but as it is of inferior purity it was not employed in these experiments, because it seemed desirable that, just at first, a potash salt should be employed as free from mixture with other substances as possible. Should the results of further experiments confirm those obtained this year, potash salts will doubtless come into use as manure; and they have one important advantage, that they are sold by analysis (as all manures ought to be), and the price is charged according to the per-centage of potash they contain.

It would be unjust in me to conclude these observations without expressing my thanks to the experimenters for the great care and attention they have bestowed on the details: And I may take this opportunity of remarking how much the progress of agriculture would be promoted if such experiments were more frequently made. If farmers' clubs were to agree among themselves to make a few experiments every year on some definite plan, and to report the results, a very few years would suffice to accumulate a highly important body of facts, from which many valuable conclusions as to the mode of action and most favourable conditions for the use of different manures, might be deduced. At present, experiments are too often made without any definite plan, and the conclusions to be drawn from them are thus greatly limited. It frequently happens, also, that too much is undertaken; and in the hurry of harvest operations the weighings are imperfectly executed, and a number of loose results are obtained, where one or two careful and precise experiments would have been much more valuable.

COMPOSITION OF FISH-MANURE AND SOME SORTS OF ANIMAL REFUSE.

Although the importance of all sorts of animal matter as a manure has long been familiar, and has been frequently insisted on both by science and practice, the immense quantity of such refuse has hitherto become very partially available. The main difficulty which has stood in the way of their profitable application has been the want of a good process by which they can be converted into a portable form. The enormous quantities of fish-refuse annually

produced in Newfoundland, and even on some parts of our own coasts, has been frequently pointed out as a source from which agriculture might derive valuable assistance. Considerable interest was excited some time since by the proposal of various methods by which the desirable object of rendering fish offal portable might be attained, and very important results were anticipated from them. As yet these anticipations have not been fulfilled, material difficulties having been encountered in carrying most of the processes into operation on the large scale, some of the plans proposed having proved too expensive in practice, while others are so obviously unpractical that no one has been found willing to invest capital in carrying them out. The error in most cases has lain in the employment of expensive machinery, which the conditions under which such a manufacture must be carried out may be said to preclude. It is probable that the quantity of fish offal to be obtained at any one spot will not generally be very large, and will be chiefly collected at one period of the year, so that the machinery would require to be sufficient to work up with rapidity the whole of the offal produced, and would lie idle during the rest of the year. It is in some such way that most of the plans have hitherto failed; but I have recently analysed a sample made by a patent process, which is said to be simple and inexpensive; and should the manufacture yield on the large scale a material of uniform quality, and equal to that I have examined, it will undoubtedly prove a very important addition to the list of ammoniacal manures.

The manure was in the form of a yellowish powder, in grains about the size of fine oatmeal, remarkably uniform in appearance, very dry, and almost devoid of smell. Its composition was:—

Water,	8.00
Fatty matters,	7.20
Nitrogenous organic matters,	71.46
Phosphate of lime,	8.70
Alkaline salts,	3.80
Silica,	0.84
	100.00
Nitrogen,	11.25
Equal to ammonia,	13.68
Phosphoric acid in the alkaline salts equal to 1.41 phosphate of lime,	0.65

This analysis recalls to mind that of a flesh manure manufactured by Messrs Turnbull & Company of Glasgow, an analysis of which appears in the *Transactions* of the Society (New Series, vol. v. p. 203).

There can be no doubt, that if fish manure, of equally good quality, can be produced, a large demand for it will soon be created. It is, in fact, a very valuable manure, and its price may be estimated very readily, according to the mode employed for Peruvian guano, by taking the commercial value of each of its

important manurial constituents as derived from other sources. The values usually adopted by chemists have been at the rate of ¾d. per lb. for phosphates, and 6d. per lb. for ammonia; or, expressed in tons, £6 for the former, and £56 per ton for the latter. Upon this plan, and taking all the phosphates under one category, we estimate the value of 100 tons of the fish manure as follows:—

13.68 of ammonia at £56, ...	£766
10.11 of phosphate of lime at £6, . . .	60
Value of 100 tons, ...	£826

or almost exactly £8, 5s. per ton; and this will probably be its average value. At the present time, however, owing to the high price of bones and ammonia, its value would considerably exceed this. Sulphate of ammonia is now selling at £16 per ton, and at this price *ammonia* is worth £64, and phosphate of lime can scarcely be reckoned under £10 per ton, bones at present selling as high as £6 or even £6, 10s. If these data be taken for calculation, the value of the fish manure comes to be:—

13.68 of ammonia at £64, ...	£875
10.11 of phosphate of lime at £10, . . .	100
Value, of 100 tons, ...	£975

or £9, 15s. per ton.

In connection with this subject, it may be well to observe, that there are many sources of animal matter which must, at the present moment, be entirely wasted, although they might, with a little management, be turned to good account. Of these perhaps the most prominent is the blood and other offal of slaughter-houses in our small towns and villages. In the larger towns the blood is collected, although not very carefully, and finds its way to certain classes of manufactories in which it is employed; but in country places it is for the most part allowed to escape. It would be a matter of some interest to ascertain the annual value of the blood and offal thus lost, which is undoubtedly very large, and a great part of which might easily be saved by a very small expenditure of care. Such, however, is the carelessness of the workmen employed in slaughter-houses, that I have been informed, that even in the large towns it is with difficulty that they can be persuaded to save the blood, although its price is really considerable. Fresh blood contains nitrogen equal to about 3 per cent of ammonia, and is worth about 2d. per gallon, or nearly £2 per ton; and any farmer living near a small town might advantageously contract to take the whole of the blood at this price.

There are many other sources of animal matters which will at once occur to our readers as available for manures. Of these we may particularise the refuse of glue and oil-boiling works, which yield

annually a considerable quantity of nitrogenous offal; and the two analyses of seal and glue refuse which follow will show that, even when they are prepared without much care, they may become useful manures :—

	Seal Refuse.		Glue Refuse.
Ash,	36.81	...	53.18
Organic matter,	41.85	...	38.60
Water,	21.34	...	8.22
	100.00	...	100.00
Ammonia,	2.24	...	2.00

The large quantity of ash in these cases is due to the admixture of earthy matters for the purpose of drying up and rendering portable the animal matter; and though this has not been done in the most suitable manner, the value of the manure is about five times as great as that of good farmyard manure.

COMPOSITION OF COW DUNG AND URINE.

As it has been frequently said that cattle are on many farms to be looked upon merely as manure-manufacturing machines, it is a matter of paramount importance that there should be a correct estimate of the amount of that commodity which they are capable of producing. As yet, however, we are singularly deficient in precise information on this point. There are numerous analyses of farmyard manure, and a few of the dung and urine of different animals; but so far as I know, the experiments of Boussingault are the only ones in which an attempt has been made to determine the quantity of the different constituents of the dung and urine which are produced in the course of twenty-four hours. His experiments were made with the object of instituting a comparison between the quantities of carbon, hydrogen, oxygen, nitrogen, and ash contained in the food, and those in the excretions, and hence do not give complete information as to the value of the latter. It was therefore with much satisfaction that I availed myself of the opportunity of examining the dung and urine of milch cows, afforded me by Mr Telfer of Cunning Park, who, at the same time, carefully determined the quantity obtained during twenty-four hours. In these analyses I restricted my attention principally to the substances possessing value as manurial agents, and hence that of the urine does not give the proportions of *all* its constituents, but only of those requisite to form an estimate of its value :—

COW'S URINE.

The quantities expressed in *grains* in the *gallon*—

Organic matters,	1767.65
Ash,	1516.05
Total solids per gallon,	3283.70

The ash contained per gallon—

Potash,	779.28
Soda,	87.26
Phosphates of lime and magnesia,	24.33
Phosphoric acid combined with the alkalies,	3.58
Ammonia,	312.11

COW-DUNG.

	Per cent.
Water,	81.78
Organic matters,	15.30
Ash,	1.02
	100.00
Ammonia,	0.35

Composition of the Ash.

Potash,	5.20
Soda,	3.74
Lime,	10.47
Magnesia,	6.39
Oxide of iron and alumina,	2.79
Phosphoric acid,	14.98
Sulphuric acid,	2.55
Chlorine,	1.80
Silica,	36.94
Charcoal,	1.81
Sand,	12.65
	99.32

According to Mr Telfer's determination, the cow yielded 27 lb. of dung during the night, and 33 during the day, or 60 in all, and this he has also found to be the average over a pretty long period. The quantity of urine in the twenty-four hours was 18 lb., and the gallon weighed 11 lb. Taking these data, the quantity of the different matters yielded in 24 hours appears to be as follows:—

Ammonia.

In the urine,	511.8 grains.
In the dung,	1470.0 „
Total,	1981.8 = 4.33 oz.

or 103.3 lb. per annum.

Potash.

In the urine,	1279.2 grains.
In the dung,	420.0 „
	1699.2 = 3.80 oz.

or 88.5 lb. per annum.

Phosphoric Acid.

In the urine,	24.6 grains.
In the dung,	1204.0 „
	1228.6 = 2.81 oz.

or 64 lb. per annum.

The other constituents have so small a value that it is scarcely necessary to take them into account in estimating the worth of the manure. If now we take the ammonia at the price of 6d. per lb., potash at 3d., and phosphoric acid at 1½d., the annual value of the excretions of one cow will stand as follows:—

	£	s.	d.
103.3 lb. of ammonia, ...	£2	11	6
88.5 „ of potash, ...	1	2	3
64.0 „ of phosphoric acid, . . .	0	8	0
Total value, .	£4	1	9

In round numbers, therefore, the annual value of the dung and urine of a milch cow may be estimated at £4.

In adopting this estimate, it is important to observe that there are several matters to be taken into consideration.

1st, It applies to a milch cow of the Ayrshire breed, and may not give a correct view of the quantities produced by animals of the larger breeds. It is probable, however, that the produce will be nearly proportionate to their weights. The weight of the cow from which the urine and dung were obtained was not determined, but it was of the ordinary size, and in all respects an average animal, so that a tolerably accurate comparison with any other kind may be made by calculating from the average weight of Ayrshires.

2d, It applies to milch cows with a fair average supply of food; and must not be supposed to give an accurate view of the produce to be obtained from cattle put up to feed. It is probable that the latter produce both dung and urine of materially greater value, at least towards the close of the period of fattening. It is known that when cattle are first put up they produce poor dung, for they thoroughly exhaust the nutritive matters contained in the food; but as they become nearly fat, they assimilate only the more really available nutriment, and hence a larger proportion of valuable matter passes off in the dung and urine, and appears in the manure. At the same time it is not impossible that the uniform system of feeding adopted with milch cows, may give a produce which does not differ from the *average* obtained at different periods of the fattening process.

3d, In estimating the value of dung and urine, it must not be forgotten that they have an effect in the production of farmyard manure over and above the mere quantity of valuable matters they yield; for as they undergo a species of fermentation, they communicate the tendency to decompose to the straw or other litter with which they are mixed, and render its valuable matters more immediately available. Straw employed alone as a manure, acts very slowly, and scarcely produces any immediate effect; but if it has partially decayed, its action is much more rapid; and in producing this decay, or fermentation, dung and urine are especially effectual.

PREMIUMS AWARDED BY THE SOCIETY IN 1855.

I.—REPORTS.

1. The gold medal to Lord Kinnaird for the Improvement of Labourers Cottages.
2. The gold medal to Keith W. Stewart Mackenzie, of Seaforth, for the greatest extent of Planting reported.
3. The gold medal, or L.10, to John Lockhart Morton, Edinburgh, for a Report on Draining.
4. The gold medal, or L.10, to John Lockhart Morton, for a Report on Peat Moss as Compost.
5. The gold medal, or L.10, to James Porter, land-steward, Monymusk, Aberdeenshire, for a Report on Liquid Manure.
6. The gold medal, or L.10, to John Lockhart Morton, for a Report on Fittings for Byres and Stables.
7. The gold medal, or L.10, to John Lockhart Morton, for a Report on Pruning Trees.
8. The gold medal, or L.10, to John Lockhart Morton, for a Report on the best mode of Preserving Timber.
9. The gold medal, or L.10, to John Lockhart Morton, for a Report on the Comparative Value of the Different Kinds of Bark.
10. The gold medal, or L.10, to John Lockhart Morton, for a Report on the General Application of Iron to the Purposes of the Farm.
11. The gold medal, or L.10, to Robert Dun, veterinary surgeon, Edinburgh, for a Report on Strangles.
12. The gold medal, or L.10, to William Hosack, Dochcarty, Dingwall, for a Report on the best means of growing and securing a sound Potato Crop.
13. The gold medal, or L.10, to James Porter, land-steward, Monymusk, Aberdeenshire, for a Report on Storing Turnips.

II.—LIVE STOCK.—DISTRICT COMPETITIONS.

CATTLE.

The County of Kinross.

HONORARY PREMIUM.

BULLS.	John Horn of Thomanean, Kinross,	Silver Medal.

MONEY PREMIUMS.

BULLS, Class II.*	James Tod, Hilton, Milnathort, . .	L.5	0	0
HEIFERS.	1. Thomas Stobie, Balnethill, Kinneswood,	2	10	0†
	2. Do. do. . . .	1	10	0†

The District of Ythanside and Formartine.

MONEY PREMIUMS.

BULLS, Class II.	William Marr, Uppermill, Tarves, .	L.2	10	0†
HEIFERS,	1. Alexander Milne, Mains of Eslemont, Ellon,	5	0	0
	2. Do. do. . .	3	0	0

* Class II., Bulls calved after 1st January 1853.
† Half premiums awarded, the number of lots being under six.

The County of Kincardine.

MONEY PREMIUMS.

BULLS, Class II.	George Brown, Pitnamoon, . .	L.5 0 0
HEIFERS.	1. William Alexander, the Bent, . .	5 0 0
	2. James Collie, Haughead, . .	3 0 0

The District in connection with the Garioch Farmers' Club.

MONEY PREMIUMS.

BULLS, Class I.*	1. Messrs Philip, Boynds, Keithhall,	L.8 0 0
	2. Alexander Robertson, Tocherford, Old Rain, ...	4 0 0
Class II.	Messrs. Bruce and Baxter, Craigforthy, Keithhall, ...	5 0 0
HEIFERS.	1. John Dean, Mains of Balquhain, Keithhall,	5 0 0
	2. James Stephen, Conglass, Keithhall,	3 0 0

The District of Strathspey.

MONEY PREMIUMS.

BULLS, Class I.	1. Alexander Stewart, Dalney, Advie,	L.4 0 0†
	2. John Gordon, Ballintomb, Dulnain Bridge,	2 0 0†
Class II.	Do. do. . .	2 10 0†
HEIFERS.	1. Do. do. . .	5 0 0
	2. George Smith, Dalnabo, Tomintoul,	3 0 0

The Islands of Orkney.

HONORARY PREMIUM.

BULLS.	William Balfour of Birstane, Kirkwall,	Silver Medal.

MONEY PREMIUMS.

BULLS, Class I.	1. John Johnstone, Lingrow, Kirkwall,	L.8 0 0
	2. B. M. Ranken, Muddisdale, Kirkwall,	4 0 0
Class II.	M. Calder, Elwickbank, Kirkwall,	5 0 0

DRAUGHT HORSES.

The District of Mid-Calder.

STALLIONS.	William Tod, Clifton Mains, Kirkliston, .	L.25 0 0
MARES.	George Davidson, Dean Park, Balerno, .	10 0 0
FILLIES.	William Kerr, Wester Causewayend, Mid-Calder,	5 0 0

The District in connection with the Strathendrick Farmers' Society.

STALLIONS.	James Paterson, Waterlee, Houston, .	L.25 0 0
MARES.	John Buchanan, Coldrach, Drymen, .	10 0 0
FILLIES.	James M'Lay, Blairhoish, Strathblane, .	5 0 0

The District in connection with the Forfarshire Agricultural Society.

STALLIONS.	John Tait, Veterinary Surgeon, Meigle, .	L.25 0 0
MARES.	Alexander Kydd, Balmirmur, Arbroath, .	10 0 0
FILLIES.	Peter Anderson, Carlmigie, Carnoustie, .	5 0 0

* Class I., Bulls calved before 1st January 1853.

† Half premiums awarded, the number of lots being under six.

The District in connection with the Glasgow Agricultural Society.

Two-year-old Colts.	John Robb, Clachan, Airdrie, .	L.6 0 0
One-year-old Colts.	Robert Jack, Balcarroch, Campsie,	4 0 0

SHEEP.

Leicester Breed.

The District of Buchan.

Honorary Premium.

Tups.	John Ferguson, Coynach, Ellon, .	Silver Medal.

Money Premiums.

Tups.	Alexander Bruce, Ardiffery, Ellon, .	L.2 10 0*
Ewes.	Charles Noble, Berryhill, Peterhead, .	2 10 0*

The County of Banff and Turiff District.

Honorary Premium.

Tups.	The Earl of Fife, Duff House, Banff,	Silver Medal.

Money Premiums.

Tups.	James Black, Knock, Grange, Banff,	L.5 0 0
Shearling Tups.	Andrew Longmore, Rettie, Banff, .	2 10 0*
Ewes.	Do. do. . . .	2 10 0*
Gimmers.	George Williamson, Auldtown, Turriff,	4 0 0

The District in connection with the Border and Union Agricultural Society.

Honorary Premium.

Tups.	Thomas Dickinson, Magdalenhall, St Boswell's	Silver Medal.

Money Premiums.

Tups.	Thomas Chrisp, Hawkhill, Alnwick,	L.5 0 0
Shearling Tups.	Thomas Cockburn, Sisterpath, Dunse,	5 0 0
Ewes.	Thomas Mason, Pallinsburn, Coldstream,	2 10 0*

Cheviot Breed.

The County of Roxburgh.

Honorary Premium.

Tups.	Mrs Major Oliver of the Bush, Jedburgh,	Silver Medal.

Money Premiums.

Tups.	Thomas Elliot, Hindhope, Jedburgh, .	L.5 0 0
Shearling Tups.	Do. do. . .	5 0 0
Gimmers.	Do. do. . .	4 0 0

The Island of Skye.

Honorary Premium.

Tups.	Donald Macleod, Kingsburgh, Portree,	Silver Medal.

Money Premiums.

Tups.	John Scott, Drynock, Broadford, .	L.2 10 0*

* Half Premiums awarded, the number of lots being under six.

BLACKFACED BREED.

The County of Wigtown.

HONORARY PREMIUM.

TUPS.	Captain Kennedy of Bennan, Glenap,	Silver Medal.

MONEY PREMIUMS.

TUPS.	Robert Moffat, Genwhilly, Glenluce, .	L.5 0 0
SHEARLING TUPS.	Andrew Lusk, Craigcaffie, Stranraer, .	5 0 0
EWES.	Do. do. . .	4 0 0
GIMMERS.	Do. do. . .	4 0 0

SWINE.

The District of Formartine.

HONORARY PREMIUM.

BOARS.	The Earl of Aberdeen, . . .	Silver Medal.

MONEY PREMIUM.

BOARS.	1. George Shepherd, Shethin, . .	L.4 0 0
	2. James Skinner, Printfield, Aberdeen, .	2 0 0
SOWS.	1. Do. do. . .	3 0 0
	2. Do. do. . .	1 0 0

DAIRY PRODUCE.

The District of Lorn.

CURED BUTTER.

HONORARY PREMIUM.

Mrs Cheyne of Lesmore, ... Silver Medal.

MONEY PREMIUMS.

1. Alexander M'Kenzie, Culcharran, . . . L.3 0 0
2. Mrs M'Callum, Balinagown, ... 2 0 0

SWEET-MILK CHEESE.

1. Miss M'Dougall, Bargoillean, ... L.3 0 0
2. Mrs M'Pherson, Clachadhu, ... 2 0 0

Middle Ward of Lanarkshire.

CURED BUTTER.

HONORARY PREMIUM.

James Yuile of Newlands, East Kilbride, . . Silver Medal.

MONEY PREMIUMS.

1. David Leggat, Whitecross, East Kilbride, . . L.3 0 0
2. William Dickie, Rutheram, Glassford, . . 2 0 0

SWEET-MILK CHEESE.

HONORARY PREMIUM.

Robert Jack of Dykehead, Avondale, . . Silver Medal.

MONEY PREMIUMS.

1. Thomas Semple, Threestones, Avondale, . . L.3 0 0
2. William Wilson, Knowhead, East Kilbride, . 2 0 0

REAPING MACHINES.

1. To Messrs William Crosskill and Sons, Beverley, for the best Reaping Machine of any price, ...	L.20 0 0
2. To William Forrester, Stewarthall, for the best Reaping Machine, not exceeding L.25, ...	20 0 0

CROPS AND CULTURE.

Seeds.

The Silver Medal has been awarded to the following parties:—

The County of Renfrew.

Andrew Robertson, Hillington, Paisley, for White Wheat.
Matthew Gilmour, Inchinnan, for Sandy Oats.
Alexander Cunningham of Craigends, Houston, for Regent Potatoes.

The District of Buchan.

John Hutchison, Monyruy, Peterhead, for Early Berlie Oats.
John Logan, Lunderton, Peterhead, for Perennial Ryegrass Seed.

The County of Haddington.

George Rate, Lampockwells, Pencaitland, for April Wheat.
T. S. Mitchell Innes of Phantassie, Prestonkirk, for Chevalier Barley.
James Brodie, Linplum, Haddington, for Potato Oats.
George Rate, Lampockwells, for Late Angus Oats.
Robert Howden, Boggs, Pencaitland, for Hopetoun Oats.
James Maitland Balfour of Whittingham, Prestonkirk, for Sandy Oats.
Do. do. for Field Beans.

The District of Wester Ross.

John Mackenzie, Kinettas, Strathpeffer, for Norfolk Barley.
H. Innes Cameron, Dingwall, for Sandy Oats.
Kenneth Grant, Kinellan, Strathpeffer, for Perennial Ryegrass Seed.

The County of Nairn.

William Clark, Easter Brightmony, Nairn, for Grey Angus Oats.
John Clark, Blackhills, Nairn, for Common Barley.

The County of Banff and Turriff District.

J. C. Grant Duff of Eden, Banff, for Sandy Oats.
Alexander Morison of Bognie, Turriff, for Chevalier Barley.
J. C. Grant Duff of Eden, Banff, for Norwegian Barley.
Do. do. for Perennial Ryegrass Seed.

GREEN CROPS ON SMALL POSSESSIONS.

The Parishes of Kenmore and Killin.

1. James Anderson, Duneaves, . . .	L.3 0 0
2. John M'Laren, Machrum, . . .	2 10 0
3. Peter Campbell, Balnan, . . .	1 10 0
4. Donald M'Diarmid, Sharlarich, . . .	1 0 0

The Parish of New Pitsligo.

1. William Clark, Balnamoon,	. .	L.3 0 0
2. Charles Mackie, Balnamoon,	. . .	2 10 0
3. George Alexander, Leechesburn,	. .	1 10 0
4. George and Alexander Murray, Leechesburn,		1 0 0

MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

The Silver Medal has been awarded to the following parties:—

The District of Breadalbane.

1. James M'Callum, Leiangerston, for the Best-managed Green Crop.
2. Peter Crerar, Croftintygan, for the Best-kept Dunghill.

The Bute Farmers' Society.

Ninian Duncan, Scoulog, for the Best-managed Green Crop.

The Leochel-Cushnie Society.

William M'Combie, Tillyfour, for the Best-managed Green Crop.

PLOUGHING COMPETITIONS.

In the course of the year the Society's Medal was awarded at 81 Ploughing Competitions, the details of which are given in a previous part of this volume.

COTTAGES AND GARDENS.

For the Best-kept Cottages and Gardens.

1st Cottage Premium—L.1, 5s., and Medal when 4 Competitors; 2d,—L.1; 3d,—15s. 1st Garden Premium—L.1, 5s., and Medal when 4 Competitors; 2d,—L.1; 3d,—15s.

The County of Lanark.

Lamington.—1st Cottage Premium and Medal, Alexander Dempster; 2d, Mary Anne Lauder; 3d, Margaret Forrest. 1st Garden Premium and Medal, William French; 2d, William Fordyce; 3d, William Muir.

Lesmahagow.—1st Garden Premium and Medal, George Scott; 2d, Thomas Brown; 3d, Thomas Symington.

The County of Wigtown.

Leswalt.—1st Cottage Premium and Medal, William M'Cutchin; 2d, John Small; 3d, Andrew Kyle. 1st Garden Premium and Medal, William M'Cutchin; 2d, John Hamilton; 3d, John Wilson.

Old Luce.—1st Cottage Premium and Medal, William Hughes; 2d, Robert Hamilton; 3d, Robert Kelly. 1st Garden Premium and Medal, Robert Hamilton; 2d, Alexander Clanachan; 3d, Alexander Morrison.

The County of Forfar.

Craig.—1st Cottage Premium and Medal, Charles Falconer; 2d, James Adams; 3d, Edward M'Laren. 1st Garden Premium and Medal, Alexander Robertson; 2d, Charles Morris; 3d, James Adam.

MEDALS GIVEN IN AID OF PRIVATE COMPETITIONS.

On Lord Kinnaird's Application.

COTTAGES.

To William Philp, Broomhall. To James Henderson, Littletor.

On Mrs Douglas Baird of Closeburn's Application.

COTTAGES.

To Mrs Trotter, Closeburn.

GARDENS.

To Archibald Stitt, Closeburn.

VETERINARY COLLEGE.

Silver Medals were awarded, at the annual examination in April last, to the following parties:—

1. George Fleming, Manchester, for the best General Examination.
2. James Lambert, Manchester, for the best Examination in Veterinary Medicine and Surgery.
3. James Lambert, Manchester, for the best Examination in Anatomy and Physiology.
4. Laurence Copeland, for the best Examination in Materia Medica.
5. George Fleming, Manchester, for the best Examination in Chemistry.
6. George Fleming, Manchester, for the best Essay on the Advantages of Chemistry to Veterinary Science.
7. George Fleming, Manchester, for the best Anatomical Preparation.

All premiums not applied for within two years from the term of payment will be forfeited.

By Order of the Directors.

JN. HALL MAXWELL, *Secretary.*

EDINBURGH, *February 9th*, 1856.

REPORT ON THE IMPROVING OF WASTE LAND.

By Mr James Porter, Land-Steward, Monymusk, Aberdeenshire.

[Premium—Ten Sovereigns.]

The cultivation and enclosure of waste land have long been deemed objects of national interest, and are deservedly ranked among the great preliminary steps to agricultural improvement. The present high value of all kinds of farm produce will doubtless give a fresh impetus to the farther prosecution of these important objects; for among the variety of means adopted in this country to increase the produce of the soil, there is none so manifestly efficient as the judicious reclamation of waste land.

Notwithstanding the many extensive morasses and barren wastes which, within my recollection of thirty years, have been brought into profitable tillage, there are still large tracts of improvable land in Scotland, particularly in the west and northern counties, lying in a state of nature, only awaiting the application of skill, labour, and capital to render them a source of profitable employment and sustenance to the people, and a safe investment for proprietors. That there is still ample scope for improvement may be inferred from the latest census returns for Scotland, which give a gross total of about sixteen million acres of waste land within the kingdom. Now, it is probable that a half-million of this might be profitably reclaimed, and about a fourth more arable acres be added to our already cultivated land—or an average of 564 acres to each of the 887 rural parishes in Scotland.

It does not, however, come within my province to offer any speculative opinion as to the probable results of a general reclamation of the cultivable wastes in this country. My intention at present is to point out the modes, under various local circumstances, likely to be found most effectual in attaining that end. Before doing so, I shall here state that my knowledge of the subject is gathered from the field of experience. My occupation for the last thirty years has demanded my personal superintendence of, and assistance in, the improvement and cultivation of considerable tracts of different descriptions of waste land. In discussing the subject, my remarks will be chiefly confined to 450 acres of very stony and formidable waste land, which have been reclaimed from a state of nature under my superintendence, within the last seven years, on the estates of Monymusk, Tillyfour, and Braco, lying in the parishes of Monymusk, Oyne, Chapel of Garioch, and Inverury, and county of Aberdeen.

Two-thirds of the extent above referred to was trenched by the spade, and the remainder done by the plough. The average cost

of trenching by the spade was £11 per acre, and the draining £7, 10s. per acre; making a total average of £18, 10s. per acre. The ploughing was mostly done on dry moorish land, and cost £4, 15s. per acre, including cross-ploughing, grubbing, harrowing, holing, loading, and carting off the stones; but where draining was required, the whole average cost of improving by the plough was about £11 per acre.

Waste lands are often reclaimed by various means, as local circumstances will permit,—such as irrigation, top-dressing, embanking, warping, &c.; but the greater proportion of such, in an inland country like this, may always be thoroughly improved by the following means,—draining, trenching, liming, and fencing; and to each of these operations I shall here devote a separate section, and endeavour to give a brief outline of their nature and general system of working.

Draining.—In improving mostly all moorish and waste lands, the first step to be taken is furrow-draining. There are, however, pieces of dry moorland, which I shall by-and-by have occasion to notice, where draining may be unnecessary; but these form the exception, and not the rule. In all cases of irony deposits, often found in the subsoil of waste land, and which destroy the action of manure, and always prove detrimental to healthy vegetation, draining becomes essentially useful. Moorband pan,* as it is termed, may no doubt be broken by subsoiling; but unless the land where it exists be thoroughly freed from superfluous water, the soil will keep a strong hold of its former sterility, and the *pan* soon regain its original tenacity. In marshy, clayey, or boggy land, draining becomes quite indispensable, for without it such land can never be made friable, nor brought into anything like a workable state, and its reclamation by any other means can neither be profitable nor permanent. Its productiveness is so uncertain that it is only the force of manure, in a favourable season, that will make it produce a chance crop; whereas, when the land is drained, evaporation goes on quickly, and renders it workable at any time: the soil is also more susceptible of drawing heat, and retaining it longer, which is shown by the fact that crops ripen more equally, and considerably sooner, than on undrained land. Such are some of the principal advantages derivable from draining, showing its necessity as the first step in the reclamation of waste land. I think it better to leave such improvements undone, than to attempt the cultivation of wet marshy land without draining.

The trenched land before noticed was nearly all furrow-drained, at the same time as the process of trenching was going on, with wedge stone drains from 3 to 4 feet deep, and 18 to 27 feet apart, according to the nature of the soil and subsoil. The trenching gene-

* Coarse gravelly clay intermixed with the salts of iron and magnesia.

rally afforded plenty of stones for this purpose; but in some few instances, where stones were scarce, 1½-inch pipes were substituted, fixed by circular collars at the joinings, and laid on soles of wood where the bottom proved soft; and in such places the stone drains were bottomed with wood in the same way. In my experience I have found more drains choked by laying them without soles on soft, sandy, or spouty bottoms, than from any other cause. The furrow stone drains were always cut 10 inches wide in the bottoms; and the stones, three abreast, and from 9 to 12 inches high, as they could be found, were then set with the tapering points downwards, so as to give free openings for the water. The tops of the set stones were then packed and levelled up with small stones, and closely covered with a layer of 2½-inch metal, so that the whole body of stones was from 14 to 15 inches deep. The close topping with metal should be well attended to, as it is excellent for keeping moles and all other obstructions out of the drain; and, from the evasive habits of contractors, it is very necessary to have each drain inspected after the topping has been put on, and before the soil be returned. Clayey subsoil to the depth of 9 inches was then levelled over the stones or pipes, and firmly beaten down to prevent the ingress of water from the surface,—which cannot be too carefully excluded,—for in sudden floods, if the surface-water once find its way into the drains, it will soon make room by sweeping the soil down the drain till the conduits are completely choked. Where the subsoil was very gravelly, the stones or pipes were sometimes covered with turf; but I think this plan should be avoided as far as practicable, as the vegetable roots of the turf sometimes grow and choke the drain. I have had several cases of pipes choked in this way, stuffed quite hard with the small fibrous roots of vegetation. Clayey subsoil even of an inferior quality, or any such inert substance, is better than turf; and when the top of the drain is closely metalled, there is little danger of it going down to impede the progress of the water. The stone leaders or main drains were always cut 6 inches deeper than the furrow-drains, from 20 to 24 inches wide in bottom, with stone conduits of good dyker-work built therein, 7 inches wide by 9 inches high, which were covered with long stones closely packed, and finished with broken metal in the same way as the furrow-drains. Where the declivity was steep, or sandy in the bottom, the main stone drains were causewayed with stones, which is very essential for preventing cutting by water, and the ultimate destruction of the drains. The mouths of all main drains were built of stone and lime, and finished with a grating of iron 1 inch between the splits, to prevent the obstruction occasioned by vermin, &c. On flat lands it is difficult to secure a sufficient uniform run for the water, and in such cases I have never attempted laying off drains without the aid of a spirit-level. It often saves much labour in extra cutting, and at once shows the

workmen the proper depth required at different points to secure a sufficient declivity in the bottoms of the drains; which, with a good outfall, is the most likely means I know of preserving substantial well-laid drains for the longest period of time in a clean and useful working state. It is bad policy to lay drains without a declivity of at least 12 to 18 inches on the 100 yards; for if they are so level that the water appears doubtful which way to run, they can neither be expected to work effectually nor last for any length of time; and the evil may always be avoided by due attention to levelling the lines, and some additional cost in cutting the outfall. No expense has been spared here in securing proper outfalls, which were constructed so as to give a drop to the water of 9 to 12 inches from the mouth of the main drain. Few open ditches have been used except for outfalls, or in places where there was likely to be a large flow of surface-water; further than this they are only a waste of land—producing little, if any, effect in drying it—and should be dispensed with as far as possible. Where they were cut as outfalls, or otherwise, the slopes on the sides were generally at an angle of 45°, and from 1 to 2 feet wide in the bottoms, as circumstances required, with the stuff from the ditches trimmed back on the top, so as to give clear margins of 3 feet on each side. As open ditches are very troublesome, and expensive to keep clean, it is better to give them good broad margins, and to trim the stuff well back, which helps to prevent its falling again into the ditch.

Of all the kinds of draining which I have tried, I consider the wedge stone drain to be the most substantial and permanent; and where suitable stones can be easily got, I should always prefer it. It is better and cheaper than the metal stone drain, has stood well here, and in most cases has thoroughly dried the land. Where stones cannot be got, pipes are no doubt a good substitute, but they should never be laid without collars to fix the joinings, and soles of wood or slate. Where the bottom is soft, however, I should consider it bad economy to lay pipes in waste land, which in this country, when trenched, often produces more stones than would be sufficient to drain it two or three times over; and as the trenching proceeds, the stones can be mostly put into the drains without carting, which must save a considerable amount of horse-work in carting on pipes and off stones. Upon the whole, the grand secret in draining is to adopt the most substantial and perfect mode instead of the easiest and cheapest. It should never be done superficially. It is a lasting good, and will prove cheapest in the end when performed in the most substantial manner.

Trenching by the Spade.—Preparatory to commencing this operation, the loose stones on the surface were first carted away, which saves labour in laying them aside when trenching, and they are easiest carted away on the firm surface. The trenches, each three

feet wide, were always laid off parallel to the lines of drains, and each drain was cut and filled in whenever the trenching was completed up to its line. The drains, however, were not cut in the bottoms of the trenches (as at times is done to save labour), but in the firm ground, a foot or so clear of the last-formed trench, which makes the cleanest job, as it gives less chance of mould being hurled in with the stones when filling the drain, than when it is placed in the bottom of the trench. Where there was no natural hollow at the place of commencement, the contents of the first trench were stowed away to fill up hollows in the adjoining ground. The surface, where it was tough, was removed in pieces of 12 inches square and 4 inches thick: these were laid close with the green side flat upon the loosened subsoil of the former trench; after which the vegetable mould or soil was turned up to the depth of 8 inches, and levelled above the turf of the former trench, thus making a clearance of 12 inches deep below the solid surface of the adjoining untrenched bank. The subsoil was then loosened by picks to the depth of 6 inches, thereby making the whole depth of loose soil 18 inches; all stones above 4 inches diameter found within that depth were turned to the surface, and to prevent the small ones from being covered by the mould, they were thrown on the top of the second-last turned trench. The large boulders were broken down or blown to pieces by gunpowder, so that they could be easily carted by four men. Thus the work proceeded, trench after trench, till the whole was finished; and the rule was to complete each trench before another was begun, thereby affording less opportunity for burying stones or omitting subsoiling, which are often attempted, particularly when the work is by contract. In working upon the above system, the trench should be divided equally in pieces of so many yards long, according to the number of men employed, and two men started on each piece, which gives more justice to the workmen, and carries on the work with greater speed and regularity. But as the land is seldom of one description, the men should change places at every trench, in order that all may share alike in the stiff and easy portions of the work. Where there are numerous stones requiring blasting, it is better to have a proportionate number of borers accompanying each squad of trenchers, to get clear of the large stones as the work goes on, otherwise it can never be done so easily nor so completely. In blasting stones it is all-important for cheapness and speed to have a blacksmith who can temper the steel of the boring-irons in a proper way, especially in the boring of hard whinstone, in the doing of which I have often seen dozens of jumpers destroyed, when they were badly tempered, before effecting a bore of 2 feet deep, thereby causing much hindrance to the work in running backwards and forwards to a smithy, sometimes at a considerable distance.

This is the system of trenching which in most instances has

been pursued here, and for all obstinate and stony soils it is very substantial and effectual. From its depth it will likely stand tillage for a very lengthened period before becoming too shallow; and where pan exists, it is, I think, the only way by which waste land can ever be brought into a profitable and permanent state of cultivation. There are, however, tracts of light land, with an open subsoil, where trenching by the spade or plough to the depth of 10 or 12 inches might be found to answer better at less cost, particularly where the subsoil is open, poor, and gravelly; and of such I shall next speak as brought into cultivation by the plough.

TRENCHING BY THE PLOUGH.—This mode of reclamation can only be advantageously effected in light moorish open-bottomed land, pretty free from stones and pan; and to such it has here been chiefly confined; and where applied to any other description, it has been always with bad effect. Previous to commencing work with the plough, the surface was cleared of loose stones, and all earth-fast boulders appearing above the ground were holed and carted away. Where there was much heath, it was burned in dry weather; but I consider this plan very objectionable, as it consumes all the vegetable matters on the surface, which might be more appropriately ploughed into the soil, and thereby rendered more useful to the crops. The roots and shanks of heath are never consumed properly by surface-burning, and present nearly as great obstacles to the after-working of the ground as if they had never been scorched by fire; and before the land can be sufficiently moulded for cropping, they must either be carted away or gathered into heaps and burned upon the ground. When the heath is very strong, I should prefer pulling it at once; and when short, I should plough it over without burning, and, after freeing it from the soil by cross ploughing and harrowing, it can then be gathered in heaps and easily disposed of, which, even when burning is had recourse to, must be the ultimatum. Whins and broom should be disposed of in the same way, as their roots never consume by burning on the surface. Where a lot of these roots have been left sticking in the soil, the reaping of the crop becomes a tedious business; and instead of being done with Bell's reaper, it is rather a ticklish business for a canny scythesman with a patent cradle-scythe to make anything like tidy work. The ploughing was done the first time by a strong-built four-horse plough, fitted with a powerful and widely-set mould-board. Where the ground was ordinarily level, it was wrought with four horses, two-and-two abreast, working the furrows both ways, and the land into ridges; but where the land was steep or partially sloping, it was all ploughed down-hill with three horses abreast, which was found to be the most effectual plan, and far easier for the horses. Working down-hill keeps a steadier team, and produces a more uniform deepness than by working up-hill, when the plough naturally inclines to rise to the surface, and the horses cannot exert the

same force of draught to keep it steady. Three or four men with tramp picks accompanied the plough for the purpose of clearing the stones from the furrow, but any large boulder that required blasting was left, and marked by a wooden pin stuck beside it, till they had time to turn it out. By the system of ploughing down-hill with three horses abreast, the work, which was better done, was in quantity nearly three-fourths of that obtained by four horses; so that on all sloping land of this description I think it best to plough down-hill with three horses abreast; and the line of furrow should be in such a direction as to incline it to fall freely from the plough. On such land the work accomplished must always be very uncertain, in consequence of encountering hard and stony pieces in the ground, and the delay often caused by broken harness and implements; but on some average pieces of moor the amount of work done by three horses abreast, ploughing down-hill, was about two-thirds of an acre in ten hours. These operations were mostly performed in autumn and winter, when the land is generally soft and more easily worked; in wet weather, particularly after a storm, it works best, when other field-labour is mostly suspended. In this state it was left till the summer or autumn following, when the stones were carted into the lines of dikes; the land was then properly worked by grubbers and drag-harrows as well as small harrows, and as the soil was naturally free, a tolerable mould was thereby produced, and the most of the heather roots brought to the surface, which were then burned in heaps, and the ashes spread over the ground.

The surface now presented a fair appearance; and when lime was to be applied to the first crop, it was then spread, and the land ploughed in ridges before winter; but when guano was intended for that crop (which I think the best plan), the land was ridged up without lime, and left till spring, when the guano was sown on the furrow top, and harrowed in along with the seed. In this way the work was carried on; and the land always lay from fifteen to eighteen months from the time of the first ploughing till it was put under crop, thereby receiving all the benefits of atmospheric influence, which no doubt has a powerful effect in pulverising a new soil, and correcting the noxious substances which always exist in it. In ploughing moorland, particularly where it is rough and stony, the driving of the horses is of the greatest consequence, and much caution should be exercised in this particular. I have seen several high-spirited and valuable young animals completely destroyed by incautious driving; and the loss caused by a few such accidents would go far in defraying the cost of trenching the roughest parts of a moor with the spade: for these reasons, I am always opposed to the improvement of rough, stony, waste land by the plough. Aged steady horses are better adapted than young ones; and matured tractable oxen, when they can be got, make

the best teams for this work I ever tried: they never lose temper when the plough strikes against a stone, are true to the draught, and take it *cannily* and easily for themselves. Hard driving never makes a good job; slow, steady work (always moving) does most execution, and best to the purpose. In land of this sort but little draining was needed, and in any wet spot where it was required, the drains were put in after the land had been once ploughed, and when the stones turned up could be conveniently got for filling them.

LIMING.—Lime is, no doubt, one of the best and most essential manures applicable to the successful cultivation of waste land, and to its beneficial effects may be traced in a great measure the advanced stage to which the improvement of waste ground has arrived. Chemically, lime has the powerful effect of acting on all inert organic substances generally abounding in newly-improved land; it speedily dissolves all vegetable matters, and renders them available in the shape of easily assimilated food to plants. It also helps to neutralise all irony salts and noxious substances detrimental to healthy vegetation, and of itself constitutes in some proportion one of the mineral ingredients in all productive soils. Mechanically, lime, when applied to clayey soils in fair doses, soon renders them more friable, and thereby more easily cultivated, and better suited for all crops. There is little land that may not be more or less benefited by the proper application of lime; but most farmers are aware that, if applied in very large quantities, or too frequently, it must soon prove very injurious instead of beneficial. Heavy dressings of lime soon decompose all vegetable matters found in the soil, bring its full powers into immediate action, generally producing extra crops for a few successive years; after which it is found that the substances on which the lime had acted are wholly consumed, and the soil left much exhausted and in a very unproductive state. Hence the great caution at all times necessary in the liming of land, particularly on soils of a light and gravelly nature. We have numberless specimens of land in this state, where the mischievous effects produced by heavy liming have become nearly irreparable, where it has been ploughed, limed, and cropped, till brought almost to absolute sterility. It has become so loose that it will not hold grain crops, and to renew its fertility seems to baffle the skill of scientific and practical men. Good dressings of farmyard dung, compost of a clayey nature, heavy and frequent rollings, and the turnip crops consumed on the ground by sheep—anything to give the soil more density and vegetable matter—appear to me the only rational restoratives. It has been found on analysis that such land does by no means contain much lime; and for the sake of the grass, I should still add a little, but only at certain intervals, and in very limited quantities, which I should mix with clay or some heavy earthy

substance, and apply to the land in shape of compost, which is no doubt the safest way of liming light over-worked land.

On all newly-improved land and cold clayey soils, lime produces the best and quickest effect when applied in a fine powdery or caustic state in shape of quicklime, in quantities of from 2 to 5 tons of shells per acre, according to the nature of the land. The last-mentioned quantity will do no harm on newly-improved land of a cold clayey nature, while the former quantity, or less, will be found sufficient for soils of a lighter texture; for in all soils of a light nature it is safest to apply lime in moderate quantities at first, and the dose may easily be repeated a few years afterwards if found necessary. Lime has a powerful effect in expelling ammonia, and should never be applied in close connection with farmyard dung, soot, guano, or any such ammoniacal manures. Lime-shells may be carted home to the land at all spare times, when other operations are not immediately pressing, and laid down in heaps of 6 or 8 tons upon the land to which it is to be applied. If it is well trimmed up, and covered with turf or earth, it will be little the worse for several months; the outside of the heap may be partially slaked, but when turned over and mixed it will be found in a fine powdery state, in good order for spreading. On land of a strong nature I have generally grown the first crop of oats with guano, and, after the ground was cleared, ploughed it and applied the lime in autumn, covering it in then with a lighter furrow, thereby giving it time to incorporate with the soil and act upon the vegetable matters before the second grain crop was sown. On moorish land of a light nature, where it is better to take only one grain crop before turnips, the lime may be ploughed in lightly in autumn, and the oats sown the following spring; or such land may be grain-cropped the first time with guano, and put under turnips next year—if possible, eaten off with sheep; and the following spring it may be dressed with lime and harrowed in with the grain and grass seeds. I prefer taking two grain crops before turnips from tough clayey land, as after one grain crop it is often very obstinate to mould; but on moorish land one grain crop should only be taken, as two grain crops in succession are severe on such land.

The land reclaimed here was mostly limed before laying it out in grass; and where this was omitted, the defect in the grass was most striking. The unlimed land produced nothing but coarse herbage, while the rest yielded abundance of grass of the best description. Lime produces the speediest effect upon grass when spread on the top of the furrow and harrowed in along with the seed; but for other crops I think it better and safer for the lime to plough it into the soil with a light furrow. Of all kinds of crops I believe grass to be the most benefited by the use of lime.

FENCING.—In connection with these improvements there have been nearly 40,000 lineal yards of different descriptions of stone dikes, built solely at the expense of the proprietors, mostly as boundaries to the farms, and along the sides of public roads, besides a considerable extent of subdivision dikes erected by the tenants, for which they receive payment at the expiry of their respective leases; the proprietors bear the expense of building all boundary dikes, upon condition that the tenants always cart the stones. Before, however, the tenants commenced to do this, the lines of dikes were pinned off by the inspector; the surface-soil was removed from their sites, that the building might be founded on the firm subsoil; the bottoms were levelled and equalised as far as practicable, that the tops of the dikes, when finished, might present some degree of uniformity. The foundation-stones were then laid on the subsoil, and where the bottom was soft the soil was thrown out, and small stones packed in till a firm footing was obtained. When the dike happened to cross a water-course, an eye of sufficient size was built in it of large hammer-blocked stones, properly squared; and the foundation-stones were sunk at least 9 inches below the bottom of the water-run; a yard on each side of the dike, along the line of the water-course, was also strongly causewayed. It is very important for the safety of dikes that all water-runs in any way connected with them be *strongly* shod with stones in the bottoms.

Double Dikes.—These were built 3 feet wide at the bottom, and 18 inches wide on the top, before the coping was put on, and stood 4½ feet high, including a coping of 6 inches, and were mostly built of what is termed rubble-work. The largest and roughest stones were laid in the foundation, well packed with small stones, and brought to a proper level at the height of 18 inches from the ground. The stones above this were laid with their best beds lowermost, properly packed, and banded by a sufficient number of throughbands, and neatly levelled at the height of 4 feet, before the coping was put on. The coping-stones, which were 6 inches high, were squared and laid on their flattest beds, and projected 2 inches on each side. The average cost of this kind of dike was 6d. per lineal yard, including excavating the foundation.

Sunk Dikes.—They were 30 inches wide at the bottom, 16 inches wide at the top, and 4½ feet high; the inside was built roughly overhand, and the outside, as well as the coping, in the same way as already described. The sunk was cut 2½ feet deep, and the contents of it beaten firmly up to the back of the stones, and raised 6 inches higher than the coping. The backing was formed 1 foot wide on the top, and sloped to an angle of 45°. The whole breadth on the top, including coping and backing, was

about 30 inches. The ditch in front of the dike was made from 12 to 18 inches wide, and then sloped off at an angle of 45°. Where there was much water, and particularly in soft-bottomed steep land, this space was shod with stones to prevent the water from undermining the dike, which it is very apt to do. The average cost of these were 7½d. per lineal yard.

Coursed Dikes were founded and levelled at 20 inches from the ground, as already explained, and built of three courses of well-squared stones, in regular rows of 12, 9, and 7 inches deep, and coped same as rubble dikes, and cost 9d. per lineal yard.

Rickle or Galloway Dikes.—These were built to a frame 4 feet high, but no hammer-work was put upon them; they were 3 feet wide in the bottom, and 18 inches on the top. The work went on in this fashion: Two stones were generally so laid that a third stone could be jammed firmly in between them—the stones being mostly built lengthways into the dike—all vacancies packed with small stones, and the top finished with a rough coping. We have frequently built these in places where appearance was no great object, and where there was plenty of large rough stones. They make a good fence, and are likely to stand well where the stones are pretty large; and as they can be done for 2½d. or 3d. per lineal yard, they are a considerable saving of expense.

Stone dikes, when well built of good materials, are the best, cheapest, and most durable fences that can be erected. Wooden palings are very perishable, are apt to be broken, and give no shelter; while hedges of most descriptions take a long time to grow, even where the soil suits them; and if not well kept, they soon become open and useless for a fence. Not so with stone dikes: when they fall, the materials are still available for repairing them. I should always prefer them in districts where stones can be got. The rubble double dike is the cheapest except the Galloway, and for general purposes I think it the best. It is far preferable to the sunk dike, as it forms a fence from both sides. Sunk dikes are objectionable in most places, even around plantations, where they are often used; for although they cannot be required to keep cattle into a young plantation, they may, after the wood is pretty well grown, be required for that purpose. It may sometimes be necessary to build sunk dikes along the edge of a water-course, or on a gentleman's lawn, for keeping the view entire, but for common agricultural purposes I should never use them, because I think the double dikes much better. Coursed dikes are very good when built of materials exactly suitable for them; but as it is impossible to make regular courses of inferior stones, the builder is often induced to put the best sides of the stones outermost, in order to equalise the courses, without any regard to how they may be bedded; and in consequence the dike

very soon gives way. They should only be built where the stones are large and equal, and in any place where appearance is an object, and as the cost of them is always considerably higher than that of rubble dikes, I can see little to recommend them where strength and cheapness are more desirable objects than beauty.

A general outline of the principles adopted in carrying out these improvements has now been given: I shall next give details of income and expenditure. But as the land in question was not in one continuous tract, but lying in detached fields of various sizes, within a boundary of 23 square miles, it would over-stretch the limits of this report, and become too complicated, to give a statement of the above particulars of one-half of the various pieces which have been improved; I shall therefore confine this report to a portion of the following descriptions of land, viz.:—

1st, *Wet marshy land.*
2d, *Sharp brown granite soil.*
3d, *Light moorland soil.*

1st, *Wet marshy Land* (soil intermixed with clayey loam and moss, on a firm subsoil of strong blue clay, and granite boulder-stones.)—A field of this sort was trenched and drained, on the farm of Broadsea, in the summer of 1851. The field has a westerly exposure, and its elevation is 450 feet. The trenching adopted was 18 inches deep—12 inches turned over, and 6 inches subsoiled; but where the upper soil was mossy, the whole 18 inches were turned up, in order to mix clay with the moss. The drains were stone ones—3 to 4 feet deep, and 21 feet apart—and thoroughly dried the land. The cost of the trenching was £8, 15s. per acre; draining, £7 per acre; clearing the land of stones, and proportion of cost of fencing, £2, 17s. per acre—total cost, £18, 12s. per acre.

Annexed is a detailed account of income and expenditure connected with the three first crops.

CROP 1852.

Oats.

Income.	£	s.	d.	*Expenditure.*	£	s.	d.
To 5 quarters of oats and straw, at 22s. 6d. per quarter,	£5	12	6	By one light ploughing, per acre,	£0	7	0
				„ seed per acre, 6 bush. oats,	0	13	0
				„ guano, 3 cwt. including carting,	1	16	0
				„ harrowing and rolling, per acre,	0	3	0
				„ interest on £18, 12s. at 4 per cent,	0	14	10¼
Deduct cost of one acre,	3	16	10¼	„ former value of the land,	0	3	0
Profit per acre,	£1	15	7¾	„ Total cost per acre,	£3	16	10¼

Crop 1853.

Turnips.

Income.				*Expenditure.*			
				By ploughing in autumn, .	£0	7	0
				„ grubbing and harrowing in spring, . . .	0	6	0
				„ laying down turnips, .	0	10	0
				„ hoeing do. twice, .	0	7	0
				„ turnip seed, . .	0	1	6
				„ 20 cubic yards ordinary farmyard dung, at 2s. 6d.,	2	10	0
				„ 1 cwt. guano, . .	0	12	0
				„ 6 bushels crushed bones, at 2s. 11d. . .	0	17	6
				„ interest on outlay, .	0	14	10½
				„ former value of the land,	0	3	0
				Total cost, per acre, .	£6	8	10½
				Deduct value of crop, .	5	0	0
To value of one acre of turnips,	£5	0	0	Loss, per acre, . .	£1	8	10½

Crop 1854.

Oats.

To 7 quarters of oats and straw, at 30s. per quarter, .	£10	10	0	By ploughing, per acre, .	£0	7	0
				„ harrowing and rolling,	0	3	0
				„ 2¾ tons of lime laid on, at 25s. per ton, .	3	8	9
				„ 6 bushels oats for seed,	1	2	0
				„ grass seeds, . .	0	10	0
				„ interest on outlay, .	0	14	10½
Deduct cost, per contra, .	6	8	7½	„ former value of the land,	0	3	0
Profit, per acre, .	£4	1	4½	Total cost per acre, .	£6	8	7½

Profit on Crop 1852, ...	£1	15	7½
Do. on Crop 1854, ...	4	1	4½
	£5	17	0
Lost on Crop 1853, ...	1	8	10½
Profit per acre for the 3 years, .	£4	8	1½

Or an average of £1, 9s. 4½d. per acre per annum.

Grass seeds having been sown with the grain crop after turnips, the land requires no farther labour nor expense for the next three years, which comprise three grass crops, the first of which may be cut for hay, at the end of which time there must be a handsome balance in the occupier's favour. For such land, in an inland country, I have found the above course of cropping, commonly called the six-shift, to answer best. It keeps the land clean and in good heart, and very easily made for turnips: it is well adapted for all land that naturally inclines to improve in grass; but on

very strong clays, particularly in the neighbourhood of a town, where there is always a command of manure, a four-course rotation might be more profitable; say, 1st. Grass; 2d. Wheat; 3d. Turnips or potatoes; 4th. Barley or oats, with grass seeds. Such a system, however, if generally practised, would give by far too little pasture for the rearing and feeding of stock, which in this country have been for many years the most remunerative to the farmer. Considerable pieces of this sort of land have been reclaimed here; and when properly dried, it has always produced well. Its previous value for pasturage has been reckoned at 3s. per acre, and with its improved value is now worth 27s. an acre. When dried, it becomes the most profitable land that can be improved. From its deep heavy nature, and richness in vegetable matters, it becomes at once permanently good land, so that I should always recommend improvers of wastes to reclaim this description first. No soil grows better than such mixtures of alluvial deposits and moss and clay. It often yields better crops of heavier grain, and produces grass and turnips little inferior to what is termed old infield land.

2d, *Brown Granite Soil*, containing numerous large granite stones, on a compact *wet* subsoil of rather poor yellow clay.

About a half of the land improved is comprised of this description; and for example I shall give in detail the reclamation of a waste of 17 acres, effected by the proprietor in the autumn of 1848, and still in his possession. As all the crops have been sold on the ground by roup, I am able to state the results to a farthing, and shall just give the income and expenditure on the whole piece during the rotation. The field slopes gently to the south and west, is sheltered by woods on the north and east, and is elevated 380 feet. The surface was covered with unprofitable herbage,—bent, rushes, and stunted heath. It was trenched in the usual way—12 inches turned and 6 inches subsoiled, and drained with stones, from 3 to 3½ feet deep, and 21 feet apart, and is thoroughly dry. The trenching cost £10, 15s. per acre; draining, £7, 8s. per acre; clearing off the stones, £2, 10s. per acre; diking, £1, 2s. per acre—in all, £21, 15s. per acre. The field was not ploughed previous to cropping it the first time, but, where beaten by carts, the soil was loosened by a drag-harrow before sowing the seed.

The following is a statement of income and expenditure for six years on the seventeen acres:—

Crop 1849.

Oats.

Income.	£	s.	d.	*Expenditure.*	£	s.	d.
To cash received for the crop,	£89	9	0	By 2 tons of guano, including driving, .	£21	10	0
				„ 13 quarters oats for seed, at 17s. 7d., . .	11	8	7
				„ harrowing, sowing, and rolling, at 4s. per acre,	3	8	0
				„ roup expenses, . .	1	5	0
				„ interest on £370, at 4 per cent, ...	14	16	0
Deduct expenses, . .	54	10	1	„ previous value of the land, say 2s. 6d. per acre, .	2	2	6
Profit, .	£34	18	11	Total, .	£54	10	1

Crop 1850.

Turnips, &c.

Income.	£	s.	d.	*Expenditure.*	£	s.	d.
				By 50 cubic yards inferior stable dung, at 3s. including carting,	£7	10	0
				„ 110 cubic yards street dung, at 7s. 6d. per yard, laid down, .	41	5	0
				„ 2 tons guano, do. .	21	10	0
				„ ploughing in autumn, at 7s. per acre, . .	5	19	0
				„ seed, and laying down and cleaning the crop, at 17s. 6d. per acre, .	14	17	6
				„ roup expenses, . .	1	5	0
				„ previous value of the land,	2	2	6
					£94	9	0
				„ Interest on £370, at 4 per cent, ...	14	16	0
				Total cost, .	£109	5	0
				Deduct income,	98	0	0
To cash received for the crop,	£98	0	0	Loss, .	£11	5	0

Crop 1851.

Oats.

Income.	£	s.	d.	*Expenditure.*	£	s.	d.
To cash for the crop, .	£97	15	0	By ploughing, at 6s. 6d. per acre, . .	£5	10	6
				„ 28 tons of lime, including carting, at 25s. . .	35	0	0
				„ harrowing, rolling, and sowing, at 4s. per acre,	3	8	0
				„ 12 quarters oats for seed, at 17s. per quarter, .	10	4	0
				„ grass seeds, at 15s. per acre, ...	12	15	0
				„ roup expenses, . .	1	5	0
				„ interest on £370, at 4 per cent, ...	14	16	0
Deduct expenses, . .	85	1	0	„ previous value of the land,	2	2	6
Profit, .	£12	14	0	Total, .	£85	1	0

Crop 1852.

Grass.

Income.				*Expenditure.*			
To cash for grass,	£29	2	6	By rolling and spreading molehills, at 8d. per acre,	£0	11	4
				„ catching moles,	0	5	0
				„ interest on £370, at 4 per cent,	14	16	0
				„ roup expenses,	0	10	0
Deduct expenses,	18	4	10	„ previous value of the land,	2	2	6
Profit,	£10	17	8	Total,	£18	4	10

Crop 1853.

Grass.

To cash for grass,	£25	12	6	By spreading molehills and cutting weeds, at 4d. per acre,	£0	5	8
				„ catching moles,	0	5	0
				„ roup expenses,	0	10	0
				„ interest on £370, at 4 per cent,	14	16	0
Deduct expenses,	17	19	2	„ previous value of the land,	2	2	6
Profit,	£7	13	4	Total,	£17	19	2

Crop 1854.

Grass.

To cash for grass,	£26	0	0	By spreading molehills and cutting weeds,	£0	5	8
				„ catching moles,	0	5	0
				„ interest on £370, at 4 per cent,	14	16	0
				„ roup expenses,	0	10	0
Deduct expenses,	17	19	2	„ previous value of the land,	2	2	6
Profit,	£8	0	10		£17	19	2

Abstract of Crops during the Rotation.

Profit on crop 1849,	£34	18	11
Do. on crop 1851,	12	14	0
Do. on crop 1852,	10	17	8
Do. on crop 1853,	7	13	4
Do. on crop 1854,	8	0	10
Total profits,	£74	4	9
Deduct loss on crop 1850,	11	5	0
Profit on 17 acres for 6 years,	£62	19	9

or an average of 12s. 4d. per acre per annum.

The grass seeds used were of the best quality, and consisted of

1 bushel perennial rye-grass,	£0	6	0
½ peck meadow fescue,	0	0	9
½ peck meadow foxtail,	0	0	9
3 lb. cow-grass,	0	2	0
1½ lb. alsike clover,	0	3	0
2 lb. common red clover,	0	1	3
2 lb. common white clover,	0	1	3
Cost per acre,	£0	15	0

For pasture I have always found this mixture to answer well. When the first crop is intended for hay, I add one-half bushel Italian rye-grass, which increases the weight of hay very considerably, but is of little use after the first year.

As the whole work of this improvement had to be done by hiring, the expense was necessarily very high. A farmer might have done it much cheaper, working it in turns along with the other operations of his farm. The price of farm produce was all along very low, thereby lessening the profits of the improvement; but as the land is now in good order, comparatively little expense will be required to keep up its fertility through the next rotation; and as the yield of crops will likely increase, the profits may reasonably be expected to be greater. In this description of land the course of cropping, as above adopted, is eminently the best. On such quality of soil as this it is perhaps the better system to cut no hay, but pasture the grass, thereby keeping the land in better order at less expense, and the grass pays equally well by sending it to Smithfield in the shape of beef. The previous value of the land has been reckoned at 2s. 6d. per acre, and after undergoing such a course of substantial improvements, it may now be fairly set down at 22s. per acre.

3d, *Light brown moorish Soil,* on a dry open subsoil of decayed trap and gravel, and comparatively free from stones.

A large tract of this land has been reclaimed on the farm of Whitehill, about 70 acres of which have been improved by the plough, and 30 acres trenched by the spade.

COST PER ACRE OF IMPROVING BY THE PLOUGH.

	£	s.	d.
First furrow, with three horses abreast, 10 to 12 inches deep,	£1	2	6
Holing stones before and after the plough,	0	15	0
Burning heath and gathering off the roots,	0	5	0
Carting off stones before and after the plough,	2	0	0
Harrowing and drag-harrowing,	0	5	6
Ploughing the second time,	0	7	0
Total cost per acre,	£4	15	0

It will be sufficient to give a detail of a field of 12 acres average quality reclaimed in 1851, and cropped the first time in 1852.

CROP 1852.

Oats.

Income.	£	s.	d.	*Expenditure.*	£	s.	d.
To 12 acres of oats and straw, at 6 quarters per acre = 72 quarters, at 24s. 2d. per quarter,	£87	0	0	By cost of improving 12 acres by the plough, at £4, 15s. per acre,	£57	0	0
				„ 1½ tons of guano laid down,	18	0	0
				„ 9 quarters oats for seed, at 17s. 8d.,	7	19	0
				„ harrowing, rolling, and sowing, at 4s. per acre,	2	8	0
Deduct expenses,	86	5	0	„ previous value of the land, at 1s. 6d. per acre,	0	18	0
Profit,	£0	15	0	Total cost,	£86	5	0

Crop 1853.

Oats.

Income.	£	s.	d.	*Expenditure.*	£	s.	d.
To 12 acres of oats and straw, at 4½ quarters per acre = 54 quarters, at 36s. 6d. per quarter, .	£98	11	0	By 30 tons lime-shells laid on, at 28s. per ton, ...	£42	0	0
				„ two ploughings and one harrowing, at 15s. per acre,	9	0	0
				„ 9 quarters oats for seed, at 25s. 6d., . .	11	9	6
				„ grass seeds, at 10s. per acre,	6	0	0
				„ harrowing, rolling, and sowing, at 4s., .	2	8	0
Deduct expenses, . .	71	15	6	„ previous value of the land,	0	18	0
Profit, ...	£26	15	6	Total cost,	£71	15	6

Crop 1854.

Grass.

	£	s.	d.		£	s.	d.
To value of grass, at 30s. per acre, . .	£18	0	0	By rolling and spreading mole-hills, . .	£0	8	0
Deduct expenses, .	1	6	0	„ previous value of the land,	0	18	0
Profit, . .	£16	14	0	Total cost,	£1	6	0

	£	s.	d.	
Profit on the 12 acres, .	£44	4	6	for three crops.
Deduct cost of diking,	13	4	0	
Leaving a clear profit of	£31	0	6	on the 12 acres, after paying all expenses,

or £2, 11s. 8d. per acre for the three years.

For the sake of comparison, I shall just give the result of 8 acres of similar soil, fully as stony, on the same moor, as trenched by the spade to the depth of 12 inches in 1851.

Crop 1852.

Oats.

	£	s.	d.		£	s.	d.
To value of 8 acres of oats and straw, at 5½ quarters per acre = 44 quarters, at 24s. 2d. per quarter, .	£53	3	4	By trenching 8 acres, at £7, 15s. . .	£62	0	0
				„ carting off stones, at 50s. per acre, . .	20	0	0
				„ 1 ton of guano laid down,	12	0	0
				„ 6 quarters oats for seed, at 17s. 8d., . .	5	6	0
				„ one light ploughing, at 7s. per acre, . .	2	16	0
				„ harrowing, sowing, and rolling, at 4s., .	1	12	0
				„ fencing with stone dikes,	8	16	0
				„ previous value of the land,	0	12	0
				Total cost,	£113	2	0
				Deduct value of the crop,	53	3	4
Total income,	£53	3	4	Loss,	£59	18	8

Crop 1853.

Oats.

Income.				*Expenditure.*			
To value of 8 acres of oats and straw, at 4½ quarters per acre = 36 quarters, at 36s. 6d. per quarter, .	£65	14	0	By 20 tons of lime, at 28s. per ton, . .	£28	0	0
				„ two ploughings and one harrowing, at 15s.,	6	0	0
				„ 6 quarters oats for seed, at 25s. 6d., . .	7	13	0
				„ harrowing, sowing, and rolling, . .	2	8	0
				„ grass seeds, at 10s. per acre,	4	0	0
Deduct expenses, . .	48	13	0	„ previous value of the land,	0	12	0
Profit, . .	£17	1	0	Total cost,	£48	13	0

Crop 1854.

Grass.

To value of grass, at 30s. per acre, . .	£12	0	0	By rolling and spreading mole-hills, . .	£0	5	4
Deduct expenses, .	0	17	4	„ previous value of the land,	0	12	0
Profit, . .	£11	2	8	Total cost,	£0	17	4

Profit on crop 1853, .	£17	1	0	Loss on crop 1852, .	£59	18	8
Do. on crop 1854, .	11	2	8				
					28	3	8
Leaving a balance against the improvements of					£31	15	0

or £3, 19s. 4½d. per acre, at the end of the three years.

By these two modes of improving light moorish land, the result of the first three years is decidedly in favour of the plough; but I am of opinion that the trenched land is most thoroughly done, and it will likely stand the test best in after years. It is a natural consequence for the ploughing to produce best at first, as it keeps the vegetable matters nearer the surface, and mixes them better with the soil; whereas the trenching turns them more to the bottom, and often brings inferior soil to the top. But when the turf in the bottom of the trenching has once been fairly rotted, and brought up by the plough, the land will then produce better crops. However, on these moors, with an open subsoil, the plough no doubt deserves the preference in point of cheapness; and if well conducted, will be found efficient in improving such land. For this land I should prefer a five-course shift: *1st*, Oats; *2d*, Turnips, eaten off by sheep; *3d*, Oats, with grass seeds; *4th*, Grass, pastured; *5th*, Grass, pastured. I consider this a good shift for all light land, where the grass generally deteriorates the third year, and it is useless to leave it to run to a state of nature. On land of this quality there should never be more than one grain crop taken in succession; but the extent improved on this farm within a few years prevented the tenant from bringing the whole

through a course of turnip husbandry, and obliged him to lay down a considerable portion of it in grass with the second grain crop. However, the grass has held particularly well with the dressing of lime, and looked always fresh and healthy. The quantity of lime applied was, I fear, rather much for land of such light texture. It has produced well to begin with, but I strongly suspect that considerable expense and labour must be incurred to keep up the same degree of productiveness. In such cases, when it becomes nearly compulsory to lay down new land in grass without dung or a turnip crop, I should recommend it to be put under turnips when first broken from lea, and if possible get a good dressing of farm-yard dung.

The farm of Whitehill is easterly exposed, and lies at a high elevation of nearly 800 feet. About eight years ago it presented a very forbidding aspect, containing only from 40 to 50 acres of half-arable wet land, which produced little, when in grass, but rushes and other coarse herbage. The wet land has been all furrow-drained, and new land added from the adjoining moors, till it now contains about 150 acres of dry and well-cultivated land; and although somewhat inferior for grass, it produces superior crops of grain and turnips. The tenant, at his own expense, improved the greatest proportion of the waste land, and subdivided the whole farm with substantial double stone dikes to the extent of 6000 lineal yards. All the draining, as well as the erection of the farm-steading and the boundary-dikes, were done at the proprietor's expense, who also gave considerable assistance in trenching the most obstinate parts of the waste land. Altogether this improvement is very complete and substantial, and reflects credit on both parties—an encouraging landlord and a persevering tenant. As noticed before, this waste, in its original state, was worth 1s. 6d. per acre, but with its improved value, may now be reckoned at 16s. 6d. per acre.

From the foregoing statistics it will be seen that Soil No. 1 paid a fair per-centage on the outlay, and left a considerable profit to the improver; and as that kind of land is easily kept in heart, and stands cropping well at little expense, I have always thought it best worth improvement, and it is invariably found most profitable in the end. Soil No. 2 also paid a fair per-centage, and left some profit; but as it was done at a very expensive rate (it being no easy matter to work land by hiring and driving street-dung 20 miles), and its produce sold when grain was unusually low, it could not be expected to pay so well as it would have done under more favourable circumstances. Soil No. 3, from its easily improvable nature, paid far best to begin with, reimbursing the tenant's whole outlay the three first crops; but as it is difficult and costly to keep up its fertility, it will not continue to yield the same return. Such land should be very cautiously treated with lime and guano, other-

wise it will soon lose its productiveness. When the above results, even with the heavy outlay required on these obstinate and stony lands, are so far satisfactory, what may not be accomplished on many of our extensive wastes, that require little but ploughing and manure to make them produce excellent crops?

These improvements, with several hundreds of miles of drains put in the arable lands, and many excellent stone dikes, along with several lines of new roads, and some thousands of acres of hilly ground fenced, drained, and planted, altogether involving an outlay of nearly £20,000, have changed the appearance of the estates in a very material degree, and no doubt improved the climate by the removal of pools and marshes, and the increased extent of thriving plantations. Shelter is no doubt very conducive to the growth of all plants; and in any bare country, stripes of plantation will always form an important auxiliary in the successful improvement either of arable or waste land. The value and appearance of many of the farms have been also enhanced by trenching pieces of waste land, and squaring the sides of fields: about twenty small holdings or crofts have been completely improved and enlarged, which could not have possibly been effected by the tenants. The money for trenching and draining was advanced by the proprietors, at the low rate of 4 per cent, the tenants performing all cartages. Boundary-dikes, roads, open ditches, and embankments, were mostly done at the proprietor's expense. In general, the tenantry are well pleased with their improvements, and consider that they are paying them well. A spirit of improvement has been created among them, which will likely be beneficial to themselves and the properties on which they reside. It is a laudable object in any proprietor thus to seek the improvement of his estate; and when capital is judiciously expended, it will, in the majority of cases, yield him good interest, whilst at the same time he becomes a benefactor to his country, and confers a direct and valuable boon upon the labouring classes, by affording them abundance of remunerative employment.

REPORT ON STRANGLES.

By Mr Robert Dun, V.S., Edinburgh.

[Premium—Ten Sovereigns.]

Strangles is a disease peculiar to the horse. It derives its name from its affecting the respiratory organs, and causing, by their derangement, a liability to suffocation. It occurs amongst horses in a state of domestication in almost every quarter of the globe, and chiefly fixes upon young animals. Its symptoms are suffi-

ciently evident, and its treatment simple. Its true nature and causes, however, have not been sufficiently studied, and without a knowledge of these, all systems of practice must appear vague and unsatisfactory.

To render the subject as intelligible and interesting as possible, it will be advisable to consider, first, the symptoms of strangles; secondly, its nature; thirdly, its causes; and lastly, its treatment, and the means for its prevention and mitigation.

SYMPTOMS.

In ordinary cases of strangles, the disease manifests itself by nasal discharge of muco-purulent matter, by dulness and fever, and by the formation of a hard, tense, nodulated tumour either in the cellular tissue beneath the jaw, or in the substance of the sub-maxillary lymphatic glands. There is much pain on pressure in the region of the tumour, and in the neighbourhood of the larynx, as also often over the parotid glands. On account of the difficulty of swallowing, a good deal of saliva, mixed with food, escapes from the mouth. In such a case the tumour gradually becomes fluctuating, and finally, if left to itself, bursts and evacuates its contents, affording instant relief to the animal, which from this time begins to eat voraciously, quickly improves in condition, and gradually looks much better than before the attack.

All cases of strangles do not run even such a severe course as this. In some the coat only stares slightly, but there is no perceptible fever, the appetite is never impaired; and the abscess is the only recognisable symptom of the malady: sometimes even the abscess is wanting, and the only symptoms are dulness, feverishness, with staring coat, considerable debility, and slight tumefaction of the sub-maxillary and parotid glands. These quickly go off, and the animal thrives well. There are all degrees of severity between these very mild forms and that first described. As a general rule, however, when a good quantity of matter is freely evacuated from the abscesses, the animal thrives best. If the purulent matter take long to accumulate in the form of an abscess, the fever and debility become great, and the breathing much obstructed, the abscess is apt to extend inwards, and the mucous membrane of the larynx, as well as the glands at the root of the tongue, and on the pendulous palate, often participate in the inflammation. From this state of matters the animal is on the verge of suffocation. A condition somewhat resembling this occurs in what has been called "malignant strangles." The inter-maxillary tumour forms to all appearance pretty well, but after a while it gradually becomes less, from the absorption of the enclosed matter by the veins. The whole of the region of the angle of the neck is very tender, the head and tongue are much tumefied, there is great difficulty of swallowing and breathing.

The animal is in a low typhoid fever, becomes gradually weaker, and dies in a miserable condition. In such cases a *post-mortem* examination generally discloses ulceration, and in some cases even sloughing of the glandular structure of the lips, throat, and pendulous palate; the lymphatic glands filled with degenerate and feebly coagulable lymph; the veins leading from the seat of the abscesses filled with pus, and the lungs also loaded with purulent matter and imperfectly coagulable lymph. In malignant strangles, death results from accumulation in the blood of the products of arrested excretion, and the reabsorption of the pus from the first-formed abscesses. Such cases, however, are happily rare.

The abscess of strangles, though generally found in the intermaxillary space, occasionally forms in other situations, as in the parotid glands, in the lymphatic glands under the *levator humeri* muscle at the root of the neck, in the axilla, at the base of the scapula, on the quarter, in the inguinal glands, or, worst of all, in the lymphatic glands of the interior of the chest, in the mesenteric glands, or even in the brain. Cases in which the abscess occupies any of these irregular sites are usually accompanied by a good deal of systemic disturbance, and are tedious in their progress. Where the abscess forms in the mesentery, the cases are apt to prove fatal, from the evacuated pus acting as a foreign body, and inducing inflammation of the peritoneum. If the pus be deposited in the thoracic lymphatic glands, the horse is suffocated by the accumulation in the cavity of the chest. Death, however, is not an invariable consequence; for the late Mr Barlow mentioned a case in the *Veterinarian* for September 1854, in which a horse, supposed to have abscess of the lymphatic glands of the thorax, made a perfect recovery. If the pus have been formed in connection with the brain, its pressure on that important organ must generally prove fatal; but abscesses in this situation are rare. Where there is a tendency to the formation of pus in internal organs, the animal appears unthrifty, his respiration is accelerated, his pulse is more frequent than natural. The precise seat of the deposit may sometimes be indicated, if in the mesenteric glands, by colicky pains; if in the chest, by cough, difficulty of swallowing, and sometimes swelling at the lower part of the trachea; if in the brain, by gradually increasing stupor. In such cases horses generally die suddenly; but I have seen and heard of cases that lingered on in an unthrifty condition for months, and yet eventually recovered. Sometimes the formation of an internal abscess may never be suspected. Mr Philips, V.S., 7th Hussars, informs me that he once had a case in which the sub-maxillary tumour suppurated in the ordinary way, and the animal to all appearance recovered; but in about four months the horse died rather unaccountably and suddenly, and, upon *post-mortem* examination, a large abscess in the mesenteric glands was found to have burst into the cavity of the abdomen.

Age appears to exercise a considerable modifying influence upon the progress of strangles. The most common age at which animals are attacked by the disease is from two to five—in fact, when they are being brought under the influence of domestication. Cases, however, often occur of animals being attacked much younger; and, upon the whole, very young animals appear to be more severely affected than older horses, as they are less able to bear up against the disease. Thus, in a case occurring in the practice of Mr Duncan, Colinsburgh—the youngest case I ever heard of, a foal six weeks old—the symptoms were very distressing. The abscess had extended inwards, and, by preventing deglutition, had very nearly exhausted the patient before surgical aid was sought.

Horses of six, seven, and eight years of age are not unfrequently seized with strangles, and, from their high condition, suffer severely. Old horses occasionally become the subjects of the disease, and the symptoms are much aggravated before the maturation of the abscess. I have heard of horses of fifteen years old having strangles. Mr Robertson, V.S., of Kelso, has seen it in two mares, one fifteen, the other a year older. They suffered much before the tumour was fully developed. The "vives," or "bastard strangles," of the old farriers appears rather to be a consequence or remnant of the disease, in the form of indurated glands, than the malady itself. However, the term is applied so indefinitely that we cannot arrive at an accurate conception of its meaning.

The influence of temperament upon disease is a subject of much interest. In sanguine, irritable horses, the fever of strangles runs high; while in coarsely-bred, heavy-headed, lymphatic cart-horses, the abscess takes long to mature. The explanation of this influence of temperament is perhaps not very satisfactory; but in individuals of sanguine temperament the tone of the vasculo-nervous system appears to be more exalted, and impressions are felt sooner and more vividly than by those of an opposite disposition, in which, therefore, the elements of disease may remain longer in action without causing so much irritation.

An animal at grass generally gets over an attack of strangles better than when in the stable, and often continues to eat and move about as if nothing were wrong. This coincides with the fact that diseases are in general less serious the more the subjects of their attack are in their original state of nature.

It has been generally observed that a certain type of the disease is preserved in a district or particular locality during a particular season. That type may be mild or severe, and all the cases occurring in the district or locality accommodate themselves to it. Thus Hales of Oswestry * has related that he had several cases of

* *Veterinarian* for 1844, p. 597.

strangles in a gentleman's stud, most of them irregular in their progress; and that the other cases occurring in the neighbourhood exhibited a like irregular character, particularly in the development of the abscess.

In the *North British Agriculturist* for August 4th, 1854, a writer mentions: "Most of our young horses are attacked with both strangles and influenza together, and even where the strangles alone affects them, it is not the common strangles, as they break out all over the body, in the flank, shoulder, &c. One of them had an abscess in the shoulder at least a foot large every way. I will try to describe one of my worst cases. Large lumps appeared in the throat, and extended up to the ear, which in most cases, though blistered, broke and discharged a great deal, yet came on again. In a good many cases, although blistered severely, so as to take the skin off, no effect seems produced on the swelling, and it takes weeks of fomentation to make it soft enough for opening. The lips and mouth swell enormously, and break out in little holes, which discharge a good deal of matter. Some of the animals nearly choke; you would hear the noise they make in breathing a good way off. There is also great debility, and no appetite. One died yesterday; an abscess burst inside, and choked him: his lungs were completely full of matter." The above description plainly shows that a severe form of the disease existed in the district referred to by the writer.

It is curious sometimes to observe that, when strangles is running through a stock, one or several of the young animals, apparently exposed as much as the rest to the influence of the disease, do not become affected by it, and may take it by themselves at some subsequent period. It indeed happens that some horses never take the disease at all; and we may suppose that in such cases the predisposition, whether congenital or otherwise, is not sufficient to form a nidus for the reception of any of the exciting causes of the disease. To this we have a striking analogy in the case of small-pox and measles in the human subject. Some individuals who are pre-eminently exposed to the attack of the disease, who inhabit the same house, who breathe the air of the same apartment, who come into close contact with persons actually suffering under small-pox, escape its influence even when using no precautionary measures. But on another invasion of the malady, when using all the means of prevention, they now become the subjects of its virulence. In support of this opinion, Dr Watson cites the following examples: "A man, who believed that he had had the small-pox, lived for twelve years as a nurse in an establishment for the reception of persons inoculated with that disorder. At the end of that time he caught the small-pox, which proved fatal to him. Now this might have been, and probably was, as the man sup-

posed, a *second* attack. The late Mr Lockley told me an instance still more remarkable, as being free from that ambiguity. Nearly the first patient he ever attended, if not the very first, was an old woman, who for years had been in the habit of going from village to village as a nurse, and of nursing a great number of persons labouring under small-pox, which she had never had, and against which she naturally enough believed herself proof. At length she was taken ill, and died of small-pox, under Mr Lockley's observation, at the age of eighty-four. Take one more instance from another of these disorders. In 1845, a lady with whom I am acquainted went through an attack of measles, that disease being prevalent in the village where she was then residing. She had never had the measles previously; yet she had, long before, personally tended eleven of her twelve children when ill of the same complaint."* These cases tend to show that the predisposition to certain avowedly contagious diseases, often remains latent for a considerable length of time; and that an exciting cause, which may seriously affect one individual, will not have the slightest influence upon others, to whom all the other external circumstances are the same. And so it happens eminently with strangles. Some few horses, moreover, appear to be quite unsusceptible to the influence of strangles. If in early life they are not subjected to the action of sufficiently strong exciting causes, their congenital predisposition to the disease may gradually wear itself out, and the blood assume a normal composition. It may, however, be doubted whether a predisposition to strangles has in all cases ever existed. I at present know of some aged horses which I am satisfied have never had strangles; and instances of a like immunity must recur to the memory of every one.

On the other hand, the predisposition seems occasionally so intense that one attack of the disease is insufficient to exhaust it, and it remains rankling in the blood till it is thoroughly destroyed by a second or third attack. Second attacks of strangles are not particularly common, but a properly authenticated case of a third attack is unique. The late Mr Barlow, of the Edinburgh Veterinary College, however, met with such a case, in which each attack was well marked, distinct, and duly authenticated.

NATURE.

The opinions regarding the nature of strangles are many and various. The oldest veterinarians considered it a critical disease, and were very much of the opinion advanced by Gibson, that, by the maturation and evacuation of an abscess, frequently situated between the branches of the lower jaw, "somewhat obnoxious to

* Watson's *Principles and Practice of Physic*, 3d edition, vol. ii. pp. 711-12.

the constitution was discharged." There is reason to believe, as we hope to show, that the opinion is not an unfounded one; and in this, as in many other instances, we observe the shrewd, though quaint and crude conclusions of the despised old farriers adopted and confirmed by their more philosophical and scientific successors. Some authorities, as Dupuy, have catalogued it as a scrofulous disease—an idea, however, which could only have been entertained in the early infancy of pathology. For although resembling scrofula in involving the glands of the body, it differs from it in running a rapid and favourable course, and generally leaving the animal in a perfectly healthy condition. Others again, as Hurtrel d'Arboval, have considered it as in nowise distinct from catarrh in its causes, progress, and consequences. This opinion is manifestly erroneous, for strangles has many distinguishing pathognomonic characters. Thus it is peculiar to the equine species, whereas catarrh attacks all animals; it exhibits a preference for young animals, whereas catarrh attacks animals of all ages; it shields the patient from a subsequent attack, whereas catarrh, like other inflammatory affections, is prone to recur in those previously affected. All these points of singularity reasonably lead to the conclusion that strangles is a specific disease, and quite distinct, therefore, from common catarrh.

Others, as Blaine, Percival, and Dick, have more decidedly stated it to be an *exanthema* or *eruptive fever*, similar to smallpox, measles, scarlatina, &c., in man, and to the murrain of cattle, sheep, and pigs. To substantiate this opinion, which appears to be the one most worthy of adoption, it will be necessary to state the distinguishing characters of the eruptive fevers:—

I. They are marked by *fever* which runs a definite course.
II. They are identified by an *eruption* which undergoes a regular series of changes.
III. They attack an individual but *once* in a lifetime.
IV. They are almost certain to attack *every* individual.
V. They sometimes spread *epidemically*.
VI. They run a definite course; and hence are best treated on the principle of *non-intervention*.
VII. They are propagated by a *specific contagion*.

I shall now endeavour briefly to show that strangles possesses these peculiarities, and is therefore fully entitled to be ranked as an eruptive fever or exanthema.

I. The Exanthemata are marked by *fever* which runs a definite course.

Fever is one of the characteristic symptoms of strangles. It generally sets in before the abscess appears, runs on to its height while the tumour is maturing, and declines at once when it evacuates its contents. Indeed, some consider fever as the essential phenomenon of the disease—an opinion which derives some weight

from the fact that cases occur in which the only observable symptoms are fever and debility, with the ordinary indications of catarrh; and such peculiar cases have been proved to be strangles by the animals enjoying a subsequent immunity from the disease.

II. Exanthemata are identified by an *eruption* which undergoes a regular series of changes.

An abscess, eruption, or breaking-out, is eminently characteristic of strangles. Some authorities, however, have doubted the propriety of classing the abscess with eruptions; but the term eruption is not applied at all precisely; it designates alike the rash of measles and scarlet fever, the pustules of small-pox or chicken-pox, and the scaly appearance presented by many skin diseases. Besides, as it is used in many cases to denominate the appearance of a number of small abscesses, the term may certainly be legitimately applied to one large abscess, such as that of strangles.

III. Exanthemata attack an individual but *once* in a lifetime.

As regards this very remarkable peculiarity, strangles comports itself like the exanthemata. Some cases, however, have been recorded of the disease having attacked the same horse twice; but a few exceptions do not invalidate the rule.

IV. Exanthemata are almost certain to attack *every* individual.

While most men escape any particular ordinary disease, very few escape the exanthemata. And so it is with strangles, for very few horses indeed pass through life without suffering from it.

V. Exanthemata sometimes spread *epidemically*.

Here also the analogy is traceable, for strangles sometimes prevails epizootically. As with ordinary epizootics, strangles, when it affects a number of animals in one locality, exhibits a remarkable uniformity in duration, symptoms, and consequences. The earlier cases appear to furnish the type upon which the subsequent ones are formed. Occasionally this type manifests a very malignant form, and all the cases are very severe. I am informed by a veterinary surgeon, in extensive practice in Fifeshire, that he has seen strangles become very serious in some seasons; and about eight years ago he remarked that it assumed a particularly malignant character.

VI. Exanthemata run a definite course, and hence are best treated upon the principle of *non-intervention*.

Strangles admits of none but palliative treatment. In normal cases the consummation is the formation of an abscess; and all antiphlogistic, heroic, or other remedies which retard or prevent that consummation, aggravate the disease.

VII. Exanthemata are propagated by a *specific contagion*.

Although the contagion of strangles has been denied by many,

we hope in the following pages to be able to prove that it occasionally develops contagious properties; and for this purpose it will be necessary to treat the subject at considerable length.

Contagion, indeed, cannot be cited as the principal cause of the transmission of strangles, for single cases frequently occur showing no tendency to communicate the disease to animals in their immediate neighbourhood. Where it runs a speedy course, and occurs out of doors, the contagiousness of the disease cannot usually be established. In stables, too, where the animals are not overcrowded, where free ventilation is allowed, where cleanliness is strictly enforced, the malady seldom assumes that low typhoid type in which it chiefly manifests contagious properties. The occurrence of strangles among a number of horses is generally ascribed, by those who deny the contagion of the malady, to some mysterious atmospheric influence affecting them all at the same time. But many facts may be adduced to show that the disease is often directly contagious. It attacks in largest proportion horses brought into immediate contact with the sick—a characteristic almost sufficient in itself to establish contagiousness. It does not affect the predisposed horses of a stock so simultaneously as most epizootics, and disorders traceable to atmospheric influence; but it progresses gradually, attacking its victims in more consecutive order. The correspondence of strangles with the exanthemata in the many characters already enumerated, is also a strong argument in favour of its being contagious. Agreeing with the eruptive fever in all essential particulars, it might, apart from practical observation, be inferred that it should coincide with them in this particular also. However, let us turn to facts. From private sources I have been enabled to collect several cases bearing upon the point in question. A few of the most prominent of these I here subjoin.

Case I.—Mr Balfour, V.S., Kirkcaldy, has informed me that he is acquainted with a farmer who lately bought at market four young horses, which he took home and placed in his straw-yard. Here the colts were in the company of another young animal affected with strangles. Very soon after their arrival the whole four were attacked by the disease. Now, without the aid of contagion this is certainly a very curious coincidence, for it is to be observed that all the four animals were attacked.

Mr Balfour also supplied me with the following case:—

Case II.—A young riding-horse borrowed by a gentleman of his friend took strangles; and the disease, not being attended to, ran on to glanders, which proved fatal. Three other young horses, kept in the same stable, were now attacked by strangles, which proved of a very malignant character. They, however, eventually recovered. This is also a very strong case on the contagion side of the question; for all the animals took the disease, and even

preserved the very type which had manifested itself in the first case.

Mr Duncan, V.S., Colinsburgh, states that he has "repeatedly seen it follow the introduction of a strange horse, labouring under the disease, into a healthy stud, when no disease of the kind was in the locality."

CASE III.—He also informs me of a case which appears very conclusive. "The owner of the animal in question was visiting a friend sixteen miles distant, and remained a day or two. His friend had strangles in his stable. Upon his return home the horse was dull and off his feed with catarrhal symptoms; and it has since turned out a decided case of strangles—no other cases of the disease being in the neighbourhood." Nothing, I think, could be more distinct than the action of the contagion here. The predisposed animal is brought into direct contact with others suffering under the disease; and after the lapse of a day or two, during which it is germinating, strangles appears.

CASE IV.—Mr Robertson, V.S., Kelso, observes, "that if strangles break out among young horses, they generally become affected in greater number within a given time when they are in actual contact or close proximity, than when they are kept at different places of the steading." This coincides with what is observed in all contagious diseases, and is, in fact, the most unequivocal proof of contagious transmission. He further mentions an apt case occurring in his own practice. A farmer purchased a three-year-old colt from a dealer. About six or seven days after purchase, the colt was severely attacked with a tedious form of strangles, where the sub-maxillary abscess never became properly developed. During his recovery, four young horses kept in the same stable were seized with the disease. Before being put into this stable, the animal had been in another set apart for riding-horses. On his removal from it, two well-bred two-year-olds were put into it, and both took strangles. Here we find the same animal during his illness communicating the disease to two separate lots of horses. Without admitting the influence of contagion in this case, it will be very difficult satisfactorily to explain why the four first-mentioned horses should take the disease upon the introduction of this contaminated stranger; and why two healthy horses should also become affected on being introduced into the stable from which he had just been removed.

These cases have all occurred in the practice of country veterinary surgeons, who are for the most part on the contagious side of the question. Most dealers and breeders of horses also, men of shrewd observation and much experience, consider the disease to be contagious, and are therefore careful to separate the sick from the healthy. Many excellent veterinary authorities are also contagionists.

Apsyrtus considered it a catching disease, and recommended isolation of the horse affected. Solleysel says, "You must never forget to separate the horse from all other horses, for this is a contagious distemper."

De Garsault and Bourgelat, believing in the contagion of the malady, recommend the separation of the sick from the healthy. Paulet believes it to be communicable either by inoculation or deglutition, and likens it to scab. Bringnonne, Bosc, and Sacco, all regard it as eminently contagious. Coleman says, "Strangles is certainly contagious." Mr Youatt, who was at one time a strong adherent of the non-contagion party, after communicating with many practitioners in various parts of the United Kingdom, was induced to modify his opinion; and to avow that there were "cases which he could not explain, except on the supposition of its being contagious." *

The cases which I have above enumerated are not adduced to prove that strangles is contagious in every instance. Indeed, I believe that the disorder can generally be clearly established as contagious only when it is of a low typhoid nature, and affects severely the mucous membrane of the upper air-passages. We observe, indeed, in many diseases of mucous membranes and skin, a similar tendency to become contagious. Again, whatever tends to induce the typhoid form of the disease, causes it to assume contagious properties. Thus, if strangles break out in overcrowded, filthy, and ill-ventilated stables, it is very apt to take on the contagious form, more especially if the subjects of its attack are well-bred horses, in which most diseases exhibit a serious type. In other diseases the same rule holds good. Thus pleuro-pneumonia shows itself to be contagious chiefly where it attacks cattle in dirty, ill-ventilated, and crowded cow-houses—in a word, wherever it is tedious and typhoid in its progress. In cases occurring under opposite circumstances, wherever the disease assumes the sthenic type, as in most cases attacking animals at grass, the laws of contagious transmission are not usually enforced, chiefly because deleterious morbific matters, even if produced, are immediately diluted with a large quantity of pure air, and thus deprived of noxious properties.

The appearance of strangles where the influence of contagion cannot be traced, must not be considered sufficient to prove that it is always non-contagious. A like phenomenon is observable even in diseases most notoriously contagious. Thus Dr Gregory states that at the Small-pox Hospital, London, only one case in twenty can be traced to the influence of contagion. Pleuro-pneumonia and murrain are similarly circumstanced. Comparatively few cases

* These opinions are extracted from a paper by M. Gohier in the *Veterinarian* for 1836.

of these diseases can be traced to contagion. So in regard to strangles; although it is often induced by other causes, yet there are many cases which can be traced to contagion alone. If it be not admitted that contagion occasionally exerts its influence, many cases such as those above cited would be very difficult of explanation. Indeed, no other exciting cause is so direct, concentrated, and powerful in its action as contagion. For in the transmission of a disease by contagion, the poisonous matter circulating in the blood of those first attacked is given off, along with the normal excretions from the skin and lungs, not to mention the abnormal excretion from the local eruption, and, pollen-like, is carried by the air into direct contact with the predisposed animal. This poisonous fermentescible substance is thus suspended in the air, and if ventilation be not sufficient to neutralise the influence, it enters the circulation through the pulmonary mucous membrane, and induces in the blood the changes which constitute the disease.

Some authorities deny that strangles can be produced by inoculation. On the other hand, Professor Coleman states that "it has been produced by inoculation." M. Toggia, of Turin, testifies that "he inoculated no fewer than eighty colts; some with the matter discharged from the nose before the abscess had broken, and others with the purulent matter obtained from the abscess; and in all of them he observed cough, a small discharge of mucous matter from the nostril, inflammation of the glands of the neck, and the formation of an abscess, which either broke of itself, or which he opened. The disease assumed the mildest form, and in none of the colts did it appear a second time."* It cannot be denied that inoculation has in many cases failed in producing the disease, but this is only what might reasonably be expected; for many diseases, such as cow-pox and small-pox, which are usually quite inoculable, are not always successfully inoculated. But even if strangles were not inoculable, its non-contagiousness would not thereby be established. Thus chicken-pox, a disease which is highly contagious, is seldom inoculable. The vesicles produced in that malady are, like the abscess in strangles, only caused by the irritation of the diseased blood, and the pus discharged is not the chief vehicle of the poisonous matter. In both cases alike, the blood is the seat of the disease, and its injection into the system might possibly in either case produce the disease.

From the above comparison, we find a remarkable similarity between the characters of strangles and those of the exanthemata. In fact, it is perfectly evident that strangles is identical with the eruptive fevers in all the seven peculiarities above noted; and the close correspondence we have demonstrated in so many striking features, is surely sufficient to warrant the conclusion that strangles is indeed a true exanthema.

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* *Veterinarian*, vol. ix. p. 583.

With the other exanthemata, then, strangles may be classed as a zymotic disease; that is, a disease which is the result of non-cognisable agents, but which appears to be produced in the body by a species of fermentation, established through the influence of a morbid poison, either received directly from without, or begotten in the blood itself. This ingenious explanation of the production of such diseases was first advanced by the great Liebig; and a *resumé* of his views is thus admirably set forth by Dr Watson:

"Wort is an infusion of malt, and contains sugar and gluten. Yeast is putrefying gluten, and its component particles are therefore in a state of intestine motion or transposition. When placed in contact with sugar in solution, it has the property of communicating a similar intestine motion to the elements of the sugar, whereby they arrange themselves into new and simpler forms; namely, into alcohol and carbonic acid. If there be no gluten in the wort, this would be the whole of the process, during which the added yeast disappears.

"But the decomposition or *fermentation* of the sugar reacts upon the gluten in the wort, and converts it gradually into yeast, which, mingling with the liberated carbonic acid, rises and floats upon the surface of the fermenting liquid; so that, when the process is completed, there has been produced thirty times as much yeast as was originally added to the wort.

"Now this is but a type of what happens in other fluids under analogous circumstances; and it may be laid down as an abstract principle in Liebig's, or rather his translator's words, that a substance in the act of decomposition, added to a mixed fluid in which its constituents are contained, can reproduce itself in that fluid—exactly in the same manner as new yeast is produced when yeast is added to liquids containing gluten.

"Thus the virus of small-pox (which virus is formed out of the blood) causes such a change in the blood as gives rise to the reproduction of the poison from the constituents of the fluid; and whilst this process is going on, the natural working of the animal economy is disturbed—the person is ill. The transformation is not arrested until all the particles of the blood which are susceptible of the decomposition have undergone the metamorphosis."*

This theory of Liebig's, although purely chemical, is far from unsatisfactory, as it clearly explains the phenomena of the exanthemata. In the animal economy the blood may be likened to the brewer's wort, containing two substances in solution. Of these, the first, analogous to the sugar of the wort, and, like it, capable of undergoing fermentation, is supposed to exist in the blood at birth, and to remain there, ready to be acted on by any exciting cause, until removed at the crisis of the disease. The other sub-

* Watson's *Principles and Practice of Physic*, 3d edition, vol. ii. p. 719.

stance contained in solution is analogous to the gluten of the wort, and is, like it, characterised by undergoing a process of decomposition when placed in contact with the first while fermenting. The substance which corresponds to the yeast in the production of the exanthemata consists in the accumulation and slight decomposition of matter, which should naturally be excreted from the system, or in the direct application of morbid matter by contagion. From whichever of these sources the exciting cause is derived, it acts in the same way. Itself in a state of decomposition or fermentative change, it induces a like action in the sugar-like congenital predisposing principle already mentioned, and this action is lastly transmitted to the gluten-like matter of the blood.

Among many others holding this opinion is Dr Carpenter, who remarks, "that the liability to zymotic disease depends upon the previous condition of the blood, and more especially on the presence of fermentible matters resulting from the ordinary processes of disintegration which, in the state of perfect health, are eliminated as fast as they are formed, but of which an accumulation is prone to take place, either when there are special sources of an augmented production, or when the excretory operations are imperfectly performed."*

And do we not here find an explanation of all the phenomena of strangles! The fermentible principle exists ready formed in the blood; and by the influence of exciting causes, by the undue accumulation in the vital fluid of the products of waste, by exposure to wet or cold, by alterations in diet and management, by the influence of contagion, or, in fact, by any of the ordinary causes which disturb health, the spark is applied to the latent combustible, which is thus ignited and consumed, and so utterly destroyed that it cannot again be formed in the blood. Here we find satisfactory explanation why strangles so commonly developes itself among young animals brought for the first time under the artificial conditions of domestication, to which the transition is often so great and sudden. A colt is brought up, say at four years of age, from the freedom and independence of his foalish existence, during which he breathed the pure uncontaminated air of the open heavens, was fed by nature's bounteous hand, not too sparingly or profusely, and instinctively took exactly as much exercise as enabled the system to rid itself of the necessary waste of its substance. The animal is placed at once, without any preparation, in a warm stable, not over-scrupulously clean or carefully ventilated. The free escape of the emanations from his body and excrements is thus prevented. His diet is entirely changed. He probably gets an undue quantity of a more nutritive and stimulating food than he was previously accustomed to. He is exercised, but not as before, nor in a degree proportioned to the amount of food he receives. In short, his whole

* Carpenter's *Human Physiology*, p. 203.

hygiène is altered. The functions of the animal cannot be expected to accommodate themselves at once to their new mode of action. Secretion and excretion are irregular and impaired. Products of disintegration accumulate in the blood, ferment there, and induce fermentation in the congenital principle already present. The result is dulness and fever—"the animal is breeding strangles;" and to get rid of the products thus manufactured, eruption or abscess follows. In some cases, however, this may not be necessary, and does not occur, as the ordinary channels of excretion prove sufficient to carry off the morbid matters.

CAUSES.

From the considerations just stated, it is obvious that the predisposing cause of the disease consists in the congenital presence in the blood of some "fermentative principles." The exciting causes which rouse these principles into action are very numerous, and resemble each other in their mode of action. Faulty excretion, bad ventilation, exposure to wet and cold, or alterations in diet and regimen, all produce their baneful effects in the same way, namely, by retaining in the blood various easily decomposable substances, which, in the ordinary course of nature, should be oxidised and eliminated from the system. In an imperfectly oxidised state, however, they are very prone to undergo a decomposition, which is transmitted to the congenital predisposing blood ingredient. Thus, by bad ventilation and overcrowding, carbonic acid gas collects in the atmosphere; and in accordance with the laws of gaseous diffusion, the due supply of oxygen (gas) is so impaired that the products of waste are not duly eliminated. A part of these products is given off by the skin and other excretions, and collects in the atmosphere in the form of those fetid emanations so characteristic of ill-ventilated stables, and so apt, when reintroduced into the circulation, to establish fermentative changes. The remaining part of the semi-oxidised matter is retained festering in the blood, and produces there changes as hurtful as if it had been given off and reabsorbed into the circulation. Exposure to wet and cold, by preventing a due amount of exhalation from the skin, throws upon the other excretory organs a larger quantity of matter than they are capable of eliminating; and the same effects are thus produced as by bad ventilation. Again, errors in diet are apt to produce derangements of the excretory functions of the bowels, liver, and kidneys, and corresponding evil consequences ensue. By inattention to regular and sufficient exercise, all the excretory organs are disordered, and like evil effects are engendered. Domestication, as it exposes the horse to many of these errors of hygiene, is therefore a fruitful cause of the occurrence of strangles. Besides all the exciting causes just mentioned, there is that of contagion, which, however, acts in a different way, and

the influence of which has been sufficiently dwelt upon in a previous part of this paper.

TREATMENT.

To enumerate the different modes that have at various times been adopted for the cure of strangles, would be interesting only in an antiquarian point of view, and would tend little to the elucidation of our subject. Various general directions have been from the earliest times laid down for the treatment of the disease. For example, in Gervase Markham's "Cheap and Good Husbandry, 1648,"* we find the following remedy for "strangle:" "Take southernwood and dry it to a powder, and with barley meal and the yolk of an egge make it into a salve, and lay it to the impostume, and it will ripen it, break it, and heal it." Another for "the vives" is also given: "For the vives, which is an inflammation of the kernels between the chap and the neck of the horse, take pepper one pennyworth, swine's grease one spoonful, the juyce of a handfull of rew, and vinegar two spoonfuls; mix them together, and then put it equally into both the horse's ears, and then tie them up with two flat laces; then shake the ears that the medicine may go down; which done, let the horse blood in the neck, and in the temple veines, and it is a certain cure." The certainty of such cures is now much doubted.

Until a very recent period, the treatment of strangles was very empirical, owing to the imperfect knowledge of its pathology; while even at the present time, some, disregarding the nature of the disease, still follow the older practitioners in their fruitless search after a remedy which shall prove effectual in all stages and in every form of the disease. Such blind search for so-called specifics has been a prevalent error in all ages. If such a remedy for strangles be ever discovered, which is far from likely, it must be one that shall effectually neutralise the blood-poison, the cause of the disease. To get rid of this poison, since we cannot destroy it, becomes the first indication of cure. In this we must endeavour to follow as best we can the example of nature. She strives to free the system of the elements of disease through the ordinary channels of excretion, as well as through an artificially established drain. The latter of these indications we cannot successfully imitate, but the former must be carefully attended to. We must supply pure air, to stimulate the excretion by the lungs; we must clothe and apply friction, to promote the healthy action of the skin; we must give light or green food, and mild laxatives, to keep up the evacuations of the bowels; we must administer gentle diuretics to obtain a full action of the kidneys. By all these methods the natural emunctories are maintained in active operation, and the exit of irritant matters is thus rendered easy.

* *Veterinarian*, vol. viii. p. 659.

Besides, it will be necessary to moderate the excessive development of the eruption, and to prevent the suppurative process involving the neighbouring organs. To accomplish this, and at the same time to obtain a proper evacuation of the normal abscess, must be one of the chief objects of our treatment.*

Further, during the progress of the disease it will often be necessary to support the strength of the animal, the better to enable it to throw off the toxic elements, and to overcome the weakening tendencies of the complaint.

These three indications of cure are admirably summed up by Dr Carpenter, as consisting "in promoting the elimination of the morbific matters, in keeping under any dangerous excess of local action, and in supporting the system during the continuance of the malady."*

Our attention must then be directed, in the first place, to the condition of the excretory organs. Whenever a horse is attacked—if the case do not occur in the field, and be very mild—he should at once be removed to a commodious and well-ventilated loose-box, which in all cases of disease is much preferable to keeping an animal tied up in a stall. He should have a clean and comfortable bed. He should be lightly clothed, unless previously unaccustomed to stable discipline. In addition it will often be advisable to wisp his body over with hay, and to enclose his legs in soft hay or flannel bandages. His diet should consist of mashed, or if possible green food. His appetite is often capricious, and he should be allowed to have whatever he fancies; "steaming the head, fomenting the throat, and sponging the nose," are often useful as encouraging the animal to eat. But in this, as in all instances, food should not be allowed to lie long before him, as it will only pall upon his appetite. If the intestines are not acting freely, a very small dose of aloes—say two or three drachms—may be administered. The bowels, however, may generally be kept in good order without the use of medicine, by supplying the animal with soft food and a piece of rock-salt, which he will readily lick. He should also have plenty of cold water, and the action of the kidneys may be promoted, by dissolving in it at each draught about half an ounce of nitre.

In general most attention is paid to the abscess; but if the hygienic and dietetic measures just mentioned be attended to, the suppurative process will often give very little trouble. The appearance and growth of the tumour should, however, always be watched. If it progress favourably, it will soon fluctuate, point, and open without artificial aid. In most cases, indeed, it is much better to allow the abscess to break of its own accord, unless the animal be in great pain; and by so doing, it will generally be found

* *Principles of Human Physiology*, fourth edition, p. 208.

that the return to health is more rapid, and that there is less blemish than if an opening had been made with the knife. The late Mr Barlow recently remarked, that of the many cases of strangles occurring at the Artillery Fort, Leith, those recovered most rapidly and completely in which the abscess was allowed to take its own course. When, from the great inconvenience exhibited by the animal, it seems necessary to assist nature by opening the abscess with the lancet, care must be taken that this is not done too soon, as permanent thickening of the integument and induration of the glands is thereby apt to be induced. If the abscess be situated in or near the parotid gland, there is considerable danger of wounding its delicate structure with the lancet; and in such circumstances it is better to let the abscess evacuate itself, or, if the distress be great, to make an incision through the skin and cellular tissue, and then with the finger-nail to pierce the wall of the cavity containing the matter.

If the tumour reach a certain size, but still remain hard, and show a tardiness in its growth, liberal food and tonics should be given to prevent the reabsorption of the pus, and the supervention of malignant strangles. Blisters are very commonly applied under such circumstances, with the hope of encouraging suppuration. They are, however, generally productive of more harm than good, often repressing rather than favouring the growth of the abscess. Poultices are also very inefficient as applications to cause the ripening of the tumour; for even with the famous "throat-poultice-cloth" of Mr Percivall, it is impossible to keep them in sufficiently close apposition to the abscess. Fomentations applied by means of light cloths constantly wet with hot water, are the only advisable means of promoting suppuration. On this point I cannot forbear quoting the words of Mr Barlow: "When the tumour advances steadily and naturally, a healthy suppuration and subsequent cure are almost uniform and certain results, provided the patient be judiciously nursed and well supported. Here, then, it is difficult to find an imperfection on the part of nature which any blister can obviate. On the other hand, when the tumour succeeds the catarrhal symptoms unusually late, or advances slowly and imperfectly, and the patient wastes rapidly instead of feeding, I do not think that any topical application can 'hasten suppuration' so well as very hot water cloths properly attached over the swelling, and continually kept at a temperature many degrees higher than the body. Hot-water dressing is grateful, does not irritate, favours exudation, is easily applied, and, unlike a filthy blister, is easily removed, so that we can feel the tumour as often as we please without inflicting pain. I have generally noticed that the tumour suppurates most freely and speedily when the patient drinks and eats tolerably well. One now and then meets with cases where a blister is applied almost every day in order to hasten the abscess;

instead of doing which, it prevents feeding, induces weakness, and defeats the intended end. On bathing the part for a few hours, external soreness is removed, and the patient often inclines to eat. In point of fact, the moving jaws, external heat with moisture, and increasing strength combined, do truly 'hasten suppuration.'"*

Sometimes the inflammatory process is very acute, and the glands swell up with great rapidity. In such cases it will occasionally be necessary to abstract blood; but in this we should be entirely guided by the quality of the pulse. If the swelling of the glands about the throat be so great as to occasion difficulty of breathing and deglutition, relief may be derived from steaming the nostrils by holding to the animal's head a common pail containing boiling water or a warm mash. It is common to apply this mixture to the head by means of a nose-bag; but as the breathing is already greatly embarrassed, the plan is by no means to be commended, and may, in fact, prove dangerous and even fatal if the animal be not carefully watched. An abscess of the glands about the pharynx or above the larynx, occasioning great difficulty of swallowing and breathing, may burst of itself, and discharge its contents by the mouth and nose, giving instant relief; but occasionally, when the animal runs the risk of suffocation, the operation of *tracheotomy* must be resorted to. This operation is best performed at a point about nine inches below the larynx, where the windpipe is least covered by muscle. The trachea should be exposed by a longitudinal incision of several inches in length, a section of about three-quarters of an inch square should be taken out, and a tube of some kind introduced, and retained till the abscess bursts and the parts resume their natural condition. I know of a case in which tracheotomy was performed with complete success, after the horse had fallen down insensible and suffocated. The animal soon revived; and a piece of common gas tube was arranged so as to keep the orifice open, till in two or three days the abscess burst, and the larynx resumed its natural action.

The treatment to be adopted after the abscess of strangles has been evacuated is generally very simple. By good and nutritious food, gentle exercise, and the exhibition of a course of tonics, the animal quickly improves in condition. Cases in which an abscess forms in the chest, abdomen, or brain, seldom recover by any treatment. But, tonics and food of an easily digestible and nutritive character, are the only remedies which have any chance of success. Iodine has been proposed for the treatment of such cases, but I should imagine that it cannot have much benefit.

In malignant strangles, the system should be supported by stimulants, and tracheotomy may sometimes be tried; but by these means life can in general be prolonged only for a short time.

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* *Veterinarian*, October 1854.

Some of the after effects of strangles may prove troublesome. Cases frequently occur in which, after the tumour between the jaws has healed up, there continues to be an occasional discharge of a clotty purulent matter from both nostrils. This discharge generally proceeds from the eustachian cavities, the lining mucous membrane of which has become involved during the progress of the disease, and still keeps up a chronic sort of inflammation. Collections of matter in the sinuses of the head also occasionally supervene. In such cases the discharge comes away in clots during the acts of eating and drinking, or whenever the head is depressed. Strangles sometimes gives rise to roaring, which results from the muscles of the larynx becoming atrophied in consequence of the previous inflammation.

From what has now been stated, it will be seen that strangles is generally a very simple and easily curable disorder; but as it is almost always attended with inconvenience, and occasionally with danger, it would be of importance to ascertain some means for preventing it, or at all events for rendering it as mild as possible. Such means, I think, consist in rendering the transition from freedom to slavery as gradual as possible. For example, when foals are taken up from grass, they should not be at once placed in close confinement. The first stable into which they are put should be a mere shed, and in it they should be allowed to remain for only a part of the day. Their food should be gradually changed. Their work, at first light and of short continuance, must be increased in severity and duration only by degrees. They should be kept strictly clean and comfortable in every respect. By such means they would become gradually accustomed to the treatment of seasoned horses, and the effects of domestication would be hardly perceptible. The most critical period of their existence might thus be sometimes passed without the exciting causes of disease being sufficiently strong to affect the congenital predisposing principle of the blood. Under such management, too, cases of strangles, when occurring, could not fail to be deprived of much of their danger and malignity.

From the several facts and considerations above advanced, the following conclusions may be drawn:—

I. The characteristic symptoms of strangles are fever and local abscess, generally between the branches of the lower jaw.

II. Strangles is a disease depending upon the congenital presence in the blood of some peculiar morbid principle.

III. By the action of any exciting cause, such as domestication or contagion, the congenital principle becomes an irritant, of which the system must free itself before health can be obtained.

IV. The treatment of strangles must be "*moderately* evacuant and *early* sustentative."

THE PLOUGH.

(*Discussion at Monthly Meeting, held 20th February* 1856.)

Mr Main, Whitehall, Mid-Lothian, said,—The question on the card leaves us free to presume that the plough improved *is* the best form of cultivator we can get; or we may suggest other forms of implements for stirring the soil. Thorough cultivation is the object to be gained, and so far as the manipulation of the soil is conducive to its attainment, it matters not how it is done, provided it is *well* done; but it *must* be done, and if not properly done, then we do not possess an implement adequate to the necessities of cultivation. We cannot advance in the knowledge of agricultural science, and be content with imperfect implements. Questions, operatic, economic, and productive, press on our attention, and demand inquiry into every department of a farmer's business, and neither prejudice nor association must interfere to hinder a full and impartial investigation, even though the time-honoured plough should be the subject.

The physical change effected on our soils by drainage has suggested to many the possibility of dispensing with a furrow in the process of stirring the soil; hence the hopes of the advocates for steam cultivation, by the use of rotatory steam-ploughs, digging machines, &c. Many practical men, however, doubt the expediency of introducing such implements into the process of cultivation. It may look like retrogression, but we confess our sympathy with these doubts. It is our humble opinion that we shall not be able to dispense with the use of the horse as the principal motive-power in field operations. Steam ploughing, as an abstract principle in cultivation, would be useless; and to use steam as a total substitute for the horse—in which capacity alone it can be valuable—involves so many difficulties, so many practical impossibilities, and so much cost, that its success, save as a curious instance of the triumph of intellect, promises no advantage to the practical farmer. We are, therefore, disposed to abide by our plough, and, if we can, to improve it.

We abide by the plough, also, because we do not think any other form of implement so perfectly adapted to secure the full advantages of pulverisation and aeration—processes absolutely necessary to the proper and profitable cultivation of heavy soils; and even as regards light soils, we believe that, without the aid of the plough, the process of thorough cleaning would be very imperfectly done. In fact, as the foundation for all future operations on the soil, a furrow with the plough is indispensable. A lea field, for instance, prepared for the seed with any other implement than the plough, would not only present a most unseemly

appearance, but in effect would be a failure. And even if we could overcome our repugnance to the rough and unworkmanlike look of a grubbed or steam-dug lea field, and if by such cultivation the sod would rot, and the grass cease to grow, still there remains the difficulty of harvest operations. On a field prepared as hinted at for the seed, we must make up our mind to lose much straw, and the application of a reaping-machine would be impossible.

While we advocate the plough, however, we would restrict its use. We are of opinion that it is sometimes too much used. Take, for instance, the preparation of heavy land for turnips; the use of the plough on this land in spring should, we think, be numbered with the things that were. One good tearing furrow, 10 or 12 inches deep if possible, should be given in autumn, and no more; the grubber then, in spring, set to operate on the pulverised surface, will afford a mould for the turnip seed which no possible number of furrows would secure. Indeed, by no other process of cultivation will we obtain a tilth for our turnip seed, or be warranted to hope for a good crop. Possessed of the plough and the grubber, therefore, we believe the farmer has all the implements he requires for stirring the soil. What futurity may disclose we cannot guess, and we have less care to tax our ingenuity on the subject, as we are satisfied we have expressed an axiom in the science of cultivation.

But can we improve the construction of the plough? This is a legitimate question. As an implement for ploughing lea, perhaps the plough is perfect, so far as the abstract operation is concerned. We may, and indeed we do, take exception, however, to the *false cut* which most of our ploughs exhibit in lea ploughing. Ploughwrights tell us this is indispensable, to obtain from the implement a stout shoulder on the furrow, with sufficient substance to resist the weather, and to cover the seed, and at the same time to form a square-cut and properly-angled furrow. We cannot believe this, especially as we have seen a furrow, cut without the aid of false-cutting, quite as pleasing to the eye, and fully as substantial as those with *false cuts* varying from 2 to 3 inches of unturned land. This falsity in cutting has many injurious effects, and any one of them of sufficient importance to condemn it. The obvious one is all we need refer to—namely, the fact that the whole furrow is *not* turned over; hence imperfect stirring, and the consequent difficulty attendant on subsequent ploughings. Our ploughs should turn over the whole soil to the depth of its sole-shoe, but at present they do no such thing. Most of our finer ploughs leave a considerable portion of the soil untouched. This defect—for defect it is—calls loudly for a remedy. True, the advocates for false-cutting aver that we obtain a finer, sweeter, and more perfect lea-furrow, and we grant the fact; but we split on

this rock. To secure a fine-looking lea furrow, we sacrifice the thorough usefulness of the plough, and by adapting it so specially to fine cutting on lea, we injure its applicability to rough and strong stubble-ploughing. In fact, in ploughing stubble we can neither obtain breadth nor depth with our present ploughs—most obvious defects, and which should be remedied.

We do not advocate subsoil ploughing, but unquestionably we should have an autumn furrow of a minimum depth of 10 inches. Here, too, we may be taunted with retrogression. With many, subsoil ploughing is a *sine quâ non* in cultivation. We have never found it such an absolute necessity. On a field of heavy land, with a retentive subsoil, we tested by experiment the value of subsoiling. We had 3 acres ploughed with a heavy common furrow, the plough drawn by three horses; other 3 acres we subsoil ploughed—one plough following another—and reached a depth of 15 inches; another 3 acres had the subsoil stirred, after a deep furrow with three horses, with the skeleton subsoil-plough. Seed oats were sown, and the whole managed in exactly the same way. We could distinguish no advantage in any of the crops, or, if any, it was in favour of the ordinary deep furrow. Turnips succeeded the oat crop, and in this crop the disadvantage of bringing the subsoil to the surface was very apparent. Not only had we greater difficulty in reducing the surface, but we had a poor braird and an inferior crop. But while sceptical of the benefits to be derived from subsoil ploughing, we still advocate deep ploughing; and we desiderate an implement that will give us a sufficiently deep furrow.

It is true that, with the horse for our motive-power, limits must be set to our demands on his strength. We can attain a point, but we cannot get beyond it. We ask, however, is a 10-inch furrow too much to expect with a properly constructed plough drawn by two horses? We do not think it. At present, sanguine folks believe that they do obtain a furrow 10 inches deep, because they order it to be done. We are convinced, however, that they are mistaken. Our object, therefore, is to make the delusion a reality, and we cannot see why it should not be. If we will only turn our attention to stubble-ploughing, no doubt we would succeed. It is simply because lea-ploughing, and that alone, has engrossed attention, that the stubble furrow has been so entirely neglected, and the adaptation of the plough to this description of farm labour so much overlooked. The question, however, is forcing itself on the attention of farmers, and cannot longer be neglected. The use of the grubber in the spring necessitates a more perfect autumn stubble-furrow, and of course demands an improved implement. It must be understood, however, that 10 inches is our minimum depth; if we can obtain an inch or two more, so much the better.

Another operation in which the plough is found defective, is in ploughing in manure with the autumn furrow. This practice is becoming annually of wider extent, and it has certainly many commendatory advantages. When manure is applied in this way, it is generally in what is called the "green" or unfermented state: at least it is so on farms removed to a distance from towns. Unquestionably it would be of great advantage to the farmer if his manure could be completely buried; but with our present ploughs this is impossible, and the result is not only loss, but unseemly and unbusinesslike work. The mould-boards of our present ploughs have neither size nor turn enough for this operation, and both must be attained before we can secure the desired result.

While we seek to obtain these results from the use of the plough, we must not forget its effects on our motive power. We desiderate greater results, and yet those at present attainable are often got at considerable expense of horse-labour. It is therefore necessary to solve the following proposition: Can we obtain these *increased* results, and at the same time *lessen*, or at least *not* increase, the demand on the strength and endurance of the horse? At first sight this question supposes an impossible result; but it only does so because we determine it on preconceived principles. We accept the present construction of the plough as a fixed rule, and if this rule *must* guide us, we have no alternative but to take the most perfect kind of work from it we can get, and, while we grumble, plough on. We have no fancy for this apathy, and we do not think there exists any necessity to doubt a successful solution of our problem. It appears to us that it only requires an enthusiastic application of mechanical talent, and the end will be reached. Difficulties may stand in the way, but let *this* prompt their subjugation—the necessities of agriculture require it.

We do not wish to intrude on the province of our mechanics, and there is certainly no need for us to do so. We have sufficient talent in this department; it only requires that the necessities of practice be fairly and fully brought under consideration. We may, however, throw out two or three hints which have suggested themselves. Let it be kept in mind that we have two objects in view: first, the more perfect operation of the plough, so as to obtain the highest amount of good from its use; and, second, if possible to lighten its draught. The latter object has engrossed the greatest amount of attention, and many attempts have been made to secure lighter draught, and in some instances considerable progress has been made. Much, however, remains to be done. The use of wheels to the plough was naturally suggested as a means to this end, and they have been partially successful. Two wheels are generally used, attached to the fore-part of the beam. The effect is to steady the plough, and to require less exertion from the ploughman in guiding his plough; and the horses at-

tached to these ploughs appear to move with a freer force, and to have their strength less taxed in the draught. Carry the principle further, and is it not presumable that still further advantage would be gained? Instead of two, attach *three* wheels to the plough; namely, two in front, as at present, and one behind. The effect of three wheels would be to carry the plough, and give it the movement of a balanced carriage. At present, we drag a dead weight; our object should be to make the weight *aid* its own motion. Would the use of three wheels effect this? We must remember, however, that we are driving or carrying a wedge, and that this operation will be materially affected by the *form* of wedge we drive or carry. Now, is the plough, as at present constructed, the most perfect form of the wedge we can have applied to such an implement? We think there is room for improvement; and we suggest it, that, while experimenting on wheels, we may give proper attention to the *form* of the plough. A part of the plough materially affecting its draught is the mould-board. We approve of the convex form of mould-board, but we think that those generally in use—Ponton's is the best we have seen—have their lines of build at much too great an angle to the line of draught. To lessen this angle might require a greater length of mould-board, but to this there can be no objection; especially as the greater length would enable us to get greater height, and more "turn" with a more parallel line of build.

We will now shortly glance at the improvements we desiderate on the working of the plough. These are—a *true* furrow, and at the same time a perfect one; and a deep well-formed furrow for stubble, at least 10 inches by 12. At present, it appears to us that our ploughs have too much friction to secure the latter size of furrow. The lea-furrow we have perfect enough as it is now obtained, with the exception of the false cut; this objection should be removed, and the shape and beauty of the furrow retained. An idea has suggested itself to get quit of the friction consequent on deep ploughing, and which at present is a ban to furrows of sufficient depth—namely, to substitute for the body of the cheek-plate a series of upright rollers. If this were practicable—and we see no reason why it should not be—we would materially aid in lessening draught. As at present constructed, when the plough or wedge is drawn or driven deeper into the soil, we immensely increase the friction-draught by every inch of greater depth we gain. And the reason is obvious—*we do not ease our wedge.* Now, in quarrying this is a necessity thoroughly understood and acted on. But what the quarrier does by art, we attempt to do by increased exertion on the part of our horses. *Hence our error.* We have an idea that upright rollers substituted for the cheek-plate would act in a manner similar to *the easing* of the wedge in quarrying. Perhaps, if the necessity for this principle were

steadily fixed on the minds of plough-wrights, other means could be adopted to secure it; but we give the hint as it suggests itself to us.

Before concluding, we may hint at another objection to the action of our plough, namely, the effect of the sole-shoe on the subsoil. This action has a tendency to glaze over and harden the clay of the subsoil, and thus is productive of two evils—greater difficulty in subsequent ploughing, and the retention of surface-water in the groove thus formed. Now, if possible, the bottom of the furrow should be as pervious as the surface. It is obvious that if this is not the case, we not only present an obstacle to the perfect drainage of our soils, but we greatly increase the evils complained of in heavy draught. Can this defect be remedied? We can only conceive the remedy in the adoption of rollers to the sole-shoe: or if a third and hind wheel were added to the plough, to have it notched or teethed, so that when following in the track of the sole-shoe, the notches or teeth may break up the smooth track formed by its action. We think most of the idea of the rollers, as they would not only prevent the glazing and hardening, but would, in our opinion, aid in lessening draught.

We have thus very hastily, and very imperfectly, suggested some faults in the present construction of our ploughs. A remedy for these would be of incalculable benefit, and we do trust that our enterprising mechanics will shortly discover it. We would, as a means to this end, strongly recommend competition in stubble ploughing. Lea has too much engrossed attention; stubble now demands its fair share. Ploughing competitions on stubble would direct observation more particularly to the defects or merits of the implements employed, and may ultimately result in a successful adaptation of the plough to the more perfect performance of this operation. It is possible, however, that the same plough will not be made to operate well both on stubble and lea, though it would be most desirable if it could. The part of the plough most difficult of application to the two processes is the mould-board. Now, to save the necessity for *two ploughs*, may it not be possible so to construct the body of the plough as that two mould-boards would fit and work on the same body—one for ploughing lea, and another for ploughing stubble? It will be obvious at once that such an arrangement would be of great benefit, for a multiplicity of implements on a farm is most undesirable. We now leave it with the gentlemen present to complete this discussion, and we shall be delighted if the business of this meeting shall result in the better adaptation of our *two-horse* ploughs to the necessities of improved agriculture.

Mr Scott, Craiglockhart, Mid-Lothian, said,—It may fairly be assumed that, for many years yet to come, no efficient aid in cultivating the great breadth of the soil of the country will be derived

from the use of any of those machines called steam-ploughs; and therefore, in considering what form of implement is best adapted for the cultivation of our fields, we may limit our attention to the spade, the grubber, and the plough. Of these the spade is certainly the most efficient, but at the same time the most expensive; and were we to attempt by it to overtake the cultivation of the whole arable land of the country, not only, I fear, would the cost be found to act as a prohibition, but I doubt if a sufficient number of hands, at any price, could be found to overtake the labour; and however efficiently the grubber may act in stirring the surface and extirpating weeds, it is incapable of turning over the soil, and burying beneath the leaves, grass, and stubble of a former crop, covering in the manure required to enrich the soil, or of bringing to the surface a fresh stratum of soil to be acted upon by the gases floating in the atmosphere, and to be pulverised by the ever-recurring changes in temperature and moisture. Therefore, I suspect, we must still look to the plough as the chief implement for cultivating the great breadth of the soil from which the food of the millions is to be derived. But whether the plough, as at present constructed, has attained the best form for this purpose, may well be doubted: indeed, it is somewhat difficult to say what is its present form, for in almost every different district a different form prevails. Even in the same locality we find a considerable variety of form; for instance, we will find the East Lothian, the Ponton, the Saline, the Currie, and some others, all at work within a few miles of where we now are. But the great fault under which these ploughs generally labour is, that although perhaps well adapted to turn over a furrow of from 4 to 7 inches in depth, when called upon to turn over one of 8 or 10 inches, particularly in loose soil, they not only perform the work badly, but are much heavier to draw than necessary, in consequence of carrying along with them a quantity of soil in front of the mould-board. Another fault with many is, that, while cutting a furrow 6 or 7 inches deep at the heel, the depth below the mould-board is little more than the half;—a method of ploughing which, it must be admitted, makes a very neat appearance, but when applied to well-drained and highly-cultivated land, is as absurd a proceeding as can well be conceived. These faults, however, principally arise from the form of the mould-board, and could, I suppose, be easily remedied by those conversant with designing those parts of the plough. What is required in those districts where the most improved cultivation is carried on, is a plough which, with the least expense of force, will turn over and properly lay up a furrow measuring along its whole breadth 9 to 10 inches in depth; but whether this is to be accomplished merely by an alteration on the form of the mould-board, or whether it may be facilitated by the addition of wheels, I am not prepared to say. However, I was certainly

much pleased on a recent occasion to witness the performance of Mr Finlayson's wheeled plough, which, when working on grass land, appeared to turn up a furrow 7 inches in depth with great regularity, and a small expense of horse-power.

For a long period it has been the practice of the Highland Society to award medals to the best ploughmen, to be competed for at local ploughing-matches; but many years ago I was satisfied that the work executed by those individuals who carried off the prizes, although perhaps suited for some of the poor undrained ground in the upland districts, was about the worst that could be devised for an improved system of cultivation; and I would now venture to suggest that the Society should, either in lieu of or in addition to these medals, award district premiums, to be competed for by the makers of ploughs, to be awarded to the one who produces the plough best adapted to perform a specified description of work.

It may be said that such premiums are already offered at the Society's great shows. This, no doubt, is true; but generally a great number of different implements are then to be tried in a short space of time, on a limited extent of ground, and at a season when the land is generally not in a state to afford satisfactory proof of the efficiency of the implements; whereas, if district premiums were awarded, the trials could take place at a season suitable for the operation, and when any extent of ground could be obtained so as fully to bring out the merits of the competing implements.

Mr MELVIN, Bonnington, Mid-Lothian, said,—After five years' experience of the English wheel-ploughs, he could not say that he was satisfied with their use. There were so many joints about them, through which the earth forced its way, thereby increasing the friction, and the dampsoil clogged the wheels after the slightest shower. The general draught, even under the most favourable conditions, was greater than it ought to be. As to the remarks made by Mr Scott regarding ploughing-matches, whilst agreeing with him as to the propriety of holding a district match, yet he thought that it would never do to give up local matches. These matches, in his opinion, did more to improve the ploughmen in this branch of their profession than any other plan that could be adopted. To speak of these matches as being the cause of a false system of ploughing being adopted, and of the ploughmen thereby being encouraged to adopt that system, might be true, but who were to blame for it? Was it not the Society under whose auspices these matches took place? and if this Society approved of a different kind of ploughing being practised, they could issue their directions as to what that should be, and refuse their medals, unless their rules were complied with. But it would never do to put down local ploughing-matches because they happened sometimes

to lead to what some people called abuse. There were few enough occasions already for the ploughmen meeting together and trying their skill, and he maintained that, as a rule, it would be found that the best ploughman at a match was in general the best man in all the work of the farm; for not only was a thorough and perfect command required over the horses, but an intimate knowledge of the method of trimming the implement was also essential; and the power of maintaining and keeping up with unflagging energy the same style, regularity, and equality of furrow with which he commenced, and closing the land ploughed with neatness and finish, was likewise required. Of course crested or forced work required more skill and more dexterity in the ploughman than plainer work, and hence the reason why farmers encouraged that work as being a better trial of skill. Because nobody ever thought of riding along the roads at the same pace as jockeys ride at horse-races, ought horse-races therefore to be put down? He was no advocate for forced work, but the spur and the stimulus which these matches diffused through a district was not to be dispensed with. So far as his experience had gone, those districts where no matches have been held were those where the ploughing was most defective. He did not coincide with Mr Main in his approval of very long mould-boards, because in some soils the particles of soil cohered so closely to the iron of the mould, that the friction was increased. He thought a mould intermediate between the long English ones and those now used upon the East-Lothian or Currie plough, was the best fitted for all soils; besides, the rise in several of the English moulds was rather abrupt; but different soils required different forms of board. There were moulds now made by Mr Cunningham, which, in his opinion, united in a higher degree all the qualities needed. Mr Main had referred to a mould suited to turn a furrow 10 inches by 14. Such a one he had got Mr Cunningham to make for him. It was an excellent working article; but when put on the plough, and turning over a furrow 10 inches deep by 14 broad, three horses were required.

Sir William Gibson-Craig said he wished to direct the attention of the farmers in Scotland to the superiority of Howard of Bedford's wheel-plough, in regard to lightness of draught, over the Scotch ploughs commonly in use. He was first induced to observe these ploughs by being assured by a Scotch overseer in South Wales, that in ploughing any stiff land with one of them and a Currie plough, he had found that, while the horses in the English plough performed their work with perfect ease, the horses in the Scotch plough were so oppressed by it that he was obliged to give it up, and use the English plough alone. He (Sir William Gibson-Craig) was soon afterwards present at the Berwick Show, and finding that to Howard's plough had been

awarded the first premium, beating all the Scotch ploughs, although the judges were Scotch farmers of the highest reputation for practical skill, he immediately ordered one of them. His experience has been that he can now plough to the same depth with two horses as he formerly did with three, and can consequently keep three ploughs going instead of two. This facility of draught is chiefly given by the improved form of the mould-board. In the Currie and other old Scotch ploughs the mould-board is at too obtuse an angle with the coulter, which involves great waste of power, while the English mould-board is upon the principle of the wave-line of a ship, and offers only the amount of resistance required to turn the furrow. From the form of the sole, also, the furrow-slice is cut out to the bottom, and the whole of the soil is stirred and turned over.

Mr LOCKHART MORTON, Edinburgh, said,—I am very much pleased with the suggestions thrown out by Mr Main and some of the other speakers. I wish, however, to refer to a remark which fell from Mr Melvin. If I understand him aright, he considers the plough, in its present form, a perfect implement, and all that we have to do is to train the ploughman properly. Now, while there certainly are advantages conferred by ploughing-matches in exciting the ploughmen to emulation, it must be admitted that the system of ploughing which is generally most successful at these matches is not the best for producing good returns in the form of crops. The high-crested furrow obtained by the use of "forcing irons," and the "steps and stairs" so often formed underneath the furrow-slice, do not add to the productiveness of the soil, but the latter, by holding water, rather injures it. I would by all means wish to see land well ploughed, but I think we should encourage that mode of ploughing which gives the best crops, in preference to that which, though looking well, does not yield the best return. I wish also to notice what Mr Melvin said about the mould-board of the common plough. He seems to think that by lengthening the mould-board you increase the friction, and the shorter, therefore, that it is, the easier will the draught be. While there is a point beyond which you must not go in lengthening the mould-board, yet it stands to reason that the longer it is, if you keep within that point, the easier will the draught be; and we know from what Sir William Gibson-Craig has stated, that the long-wrested English plough made by Howard is easier drawn than the common Scotch plough. There is another point upon which I should wish to make a few remarks. We know that there has been a good deal of writing, in the south of England, in favour of cultivation by steam ploughs constructed on the revolving principle. Mr Main has scarcely referred to it, but I think it should be taken notice of. We have been told by those in favour of revolving ploughs (and it has been

particularly referred to by Mr Wren Hoskyns, a most ingenious and excellent writer) that we should go to nature for our model of a plough, and the mole has been pointed to as one. Well, let us take the mole as a model. His feet act as propelling paddles, but his power is principally in his snout and shoulders. The mole, in fact, is a wedge, and we may make him a pattern from which to improve our common plough. Then, if we keep still further to nature, we may take a pig as our model. Any farmer knows that when an old long-snouted sow is let out into a grass field, she makes an excellent plougher, so far as turning up the earth is concerned. It is by her snout she turns up the soil, and it is mainly by using it on the wedge principle she does this. If we were thinking of improving upon nature, by giving the sow a revolving head, I think we must at once see that in her digging operations she would make very superficial work, and much power would be lost before she could do the same amount of effective labour she does at present. The question whether land ploughed by the common plough, or pulverised by a revolving implement, would be most benefited by atmospheric agency, is one of considerable importance. Sir John Leslie showed, many years ago, that frost descended far deeper into a compact soil than into a loose one, and further into a bare soil than into one having a surface covering. In the neighbourhood of Edinburgh he found, I think, that while frost penetrated 13 inches into newly ploughed ground, it descended only 8 inches into a soil having herbage on the surface. I will not say that frost will not descend as deeply in grubbed as in ploughed land, but I think that if there are many weeds or stubbles left on the surface of a grubbed soil, frost will not penetrate very far, for the frigorific impressions will be dissipated by such a fibrous layer. With regard to the fertilising effects of rain water the case is somewhat different, and I consider grubbed land in a better state to be benefited by it than land ploughed with the common plough will be. But then the difficulty is to get a revolving plough to do the necessary work, and till such an implement has been invented, we must keep to the old plough. I confess I have very little hope of the revolving principle doing anything for us in this matter, and to improve upon our present plough is what we ought to do. I do not say this by any means to discourage inventors. By all means let inventors think of the revolving or any other principle they choose; but I fear that, in giving too much attention to the revolving theory, they catch at a shadow—which I really think it is—and let go the substance. Let us improve our present plough, and keep to it till we get an implement better fitted to do its work.

Mr Wilson, Edington Mains, Berwickshire, said,—It would be well if those who addressed themselves to the investigation of the matters now under discussion, could come to an explicit under-

standing as to the effects which it is desirable that a plough should produce upon the soil—in other words, if they could define what really constitutes good ploughing. Sir William Gibson-Craig, in describing his experience of the working of Howard's ploughs, has shown their superiority to other ploughs as regards easy draught, and the accuracy with which they turn over the soil. But the question remained, are the turning over of the furrow-slice and the form of the slices the points of chief importance in that combination of effects which are produced upon the soil in the operation of ploughing? Was not the *disintegration* of the soil of equal, or even of greater, importance than some other aspects of the operation to which attention had been almost exclusively directed? He had been so much pleased with the performance of Howard's plough at the trial which took place at Berwick under the auspices of this Society, that he had since purchased one of them, and was glad to be able to say that he was, upon the whole, well satisfied with it. It cut out the bottom of its furrow more thoroughly than any other plough with which he was acquainted. Indeed, in the accuracy of its operation, and the steadiness of its motion, it reminded one of a planing machine. It had, however, this drawback,—that in the case of adhesive soils the slices were turned over so square and unbroken, that, on exposure to drought, they formed compact brick-like masses, which, when cross-ploughed and harrowed, yielded more and harder clods than are found after ploughs which crush and shake the slices more in the act of turning them over. Ploughs which produce much of this disintegrating effect, must be supposed to be necessarily heavier of draught than those which turn over a comparatively unbroken slice. Unless, therefore, the *whole* effects produced be as carefully ascertained as the force expended in producing them, it may easily happen that mere lightness of draught in a plough may obtain for it an unmerited reputation for general usefulness. He considered it an advantage to have wheels to ploughs, as uniform depth of work is thereby insured. Good ploughmen appear to find no great difficulty in making straight furrow-slices with swing-ploughs, but very great difficulty, indeed, in making them of uniform depth. He might mention that he continued to use the light grubber extensively as a tillage implement, and that prolonged experience fully confirmed all that he had some years since reported to this Society in regard to it.

LIST OF PLOUGHING COMPETITIONS *reported to the Society in* 1855–1856.

District.	Date.	No. of Ploughs.	Extent.	Time.	Amount of Premiums.	First Premium and Society's Medal Awarded to
ABERDEENSHIRE—						
Buchan Association, Lunderton	2 Jan. 1856	37	64 poles	in 4 hours	£3 19 6	Thomas Milne, farm-servant, Monyruy.
Ditto, Oldtown of Coynach	27 Dec. 1855	42	56 poles	in $3\frac{1}{2}$ hours	4 3 0	William Bruce, farm-servant, Kinmundy.
Coburty	27 Dec. 1855	55	$\frac{1}{3}$ acre	in $3\frac{1}{2}$ hours	3 6 6	William Park, farm-servant, Techmuiry.
Glenbucket, Mains of	13 Mar. 1856	19	$\frac{1}{3}$ acre	in 4 hours	3 2 6	Alexander Dow, farm-servant, Upperton.
Helenamore	20 Dec. 1855	19	$\frac{1}{3}$ acre	in 3 hours	3 0 0	William M'Ritchie, farm-servant, Glaslaw.
Millfield	29 Dec. 1855	29	$\frac{1}{3}$ acre	in 3 hrs. 20 m.	3 2 0	James Christie, farmer, Garmond.
Netherhills, Newhill	18 Dec. 1855	34	Rate of 1 acre	in 10 hours	4 16 0	James Still, Rivehill.
New Byth, Loanhead of ...	4 Dec. 1855	20	$\frac{1}{3}$ acre	in 3 hours	3 5 0	James Cowieson, Culbyth.
ARGYLLSHIRE—						
Barcaldine	13 Mar. 1856	16	$\frac{3}{8}$ acre	in 4 hours	3 0 0	Dugald M'Coll, Kintallen.
Clenmackrie	28 Feb. 1856	15	$\frac{3}{8}$ acre	in 4 hours	3 0 0	Robert Clark, Kilmore.
Experiment	8 Feb. 1856	21	$\frac{1}{2}$ acre	in 5 hours	3 16 0	Duncan Smith, farm-servant, Experiment.
Tombreck	29 Feb. 1856	20	$\frac{1}{2}$ acre Scotch	in 6 hours	4 0 0	Neil M'Arthur, farm-servant, Dalchenna.
West Drumore	25 Jan. 1856	28	Rate of 1 acre	in 11 hours	4 7 6	James O'May, farm-servant, Auchencorrie.
AYRSHIRE—						
Auchincruive	6 Mar. 1856	50	$\frac{5}{16}$ acre	in 5 hours	3 12 0	Thomas Lindsay, farmer, Townend.
Grougar Society, Milton ...	14 Feb. 1856	18	1 rood 13 poles	in 4 hrs. 40 m.	4 2 6	Mathew Mitchell, junior, Blackshill.
Kerelaw	13 Feb. 1856	26	Rate of 1 acre Sc.	in 16 hours	4 18 6	James Reid, farm-servant, Greenwood.
Kirkmichael Society, Orchard ...	26 Jan. 1856	32	Rate of 1 acre Sc.	in 16 hours	3 0 0	John M'Nider, Drumnhill.
Westpark, Coylton	26 Jan. 1856	20	1 rood 3 falls	in 4 hrs. 18 m.	3 15 0	William Walker, Drumsuie.
BANFFSHIRE—						
Auchorachan, Glenlivat ...	8 Jan. 1856	26	$\frac{2}{5}$ acre	in $4\frac{1}{2}$ hours	4 10 0	Charles Kemp, farmer, Reclettich.
Findon, Gamrie	7 Jan. 1856	50	$\frac{1}{2}$ acre	in 5 hours	6 15 0	Alexander Smart, farm-servant, Troup.
Monedie, Auchintoul	28 Dec. 1855	42	$\frac{1}{3}$ acre	in 4 to $4\frac{1}{2}$ hrs.	4 18 0	George Copland, farmer, Myreside.
BERWICKSHIRE—						
Belville, Eccles	31 Dec. 1855	29	$\frac{2}{3}$ acre	in $6\frac{1}{2}$ hours	4 17 6	Lawrie Birrel, farm-servant, Kennetsideheads.
Boon	9 Feb. 1856	37	$\frac{3}{4}$ acre	in 6 hours	4 10 0	James Pringle, Hindsidehill.
East of Berwickshire Club, Edington Mains ...	30 Nov. 1855	29	$\frac{7}{8}$ acre	in 7 hours	5 7 6	Robert Cleghorn, Ninewellmains.

LIST OF PLOUGHING COMPETITIONS (*continued*).

District.	Date.	No. of Ploughs.	Extent.	Time.	Amount of Premiums.	First Premium and Society's Medal Awarded to
BERWICKSHIRE (*continued*)—						
Lammermuir Club	26 Jan. 1856	25	½ acre	4½ to 5 hours	3 0 0	R. Thomson, farm-servant, Fellcheugh.
Penmansheil, Cockburnspath ...	8 Feb. 1856	21	½ acre	in 5 hours	4 1 0	Thomas Galbraith, Old Cambus.
Wedderlie, Westruther ...	29 Dec. 1855	25	¾ acre	in 7½ hours	3 8 0	Wm. Brotherstone, farm-servant, Blythe.
BUTESHIRE—						
Crenslagvurity, North Bute ...	15 Feb. 1856	47	45 falls	in 4½ hours	9 8 0	John Paton, Greenan.
CAITHNESS-SHIRE—						
Clyth	17 Jan. 1856	30	½ acre	in 5 hours	3 17 6	Alexander Miller, farm-servant, Langwell.
DUMBARTONSHIRE—						
Mollandow, Cardross	8 Feb. 1856	21	35 falls Scotch	3 hours 56 m.	7 0 0	Thomas Meikle, farm-servant, Bloomhill.
DUMFRIESSHIRE—						
Smallholms	8 Feb. 1856	20	Rate of 1 acre	in 10 hours.	5 0 6	Wm. Mackenzie, farm-servant, Greenrae.
EDINBURGHSHIRE—						
Braidwood, Penicuik	12 Feb. 1856	30	¾ acre	in 7 hours	5 0 0	William Burns, farm-servant, Mount Lothian.
Bryans, Newbattle	28 Dec. 1855	33	½ acre	in 5 hours	4 0 0	William Cairns, farm-servant, Bryans.
Buteland	4 Jan. 1856	47	½ acre Scotch	in 7½ hours	6 0 0	John Gibson, farm-servant, Broompark.
Drum	8 Feb. 1856	31	½ acre	in 5 hours	3 7 6	William Hunter, farm-servant, Cauldcoats.
Halflukill	18 Dec. 1855	30	Rate of 1 acre	in 10 hours	5 10 0	Robert Lonie, farm-servant, Stobsmills.
Hardengreen	22 Feb. 1856	39	½ acre	in 5 hours	3 5 0	Alexander Shearer, farm-servant.
Hartwood, Mid-Calder ...	8 Jan. 1856	19	1¼ rood	in 4 hours	3 6 0	Alexander Hamilton, Mossend.
Inveresk Society, Monkton ...	28 Jan. 1856	30	¾ acre	in 7½ hours	3 6 0	Robert Kirkwood, farm-servant, Crookston.
Moorfoot	31 Dec. 1855	28	½ acre	in 5½ hours	3 10 0	William Mitchell, farm-servant, Mauldslie.
ELGINSHIRE—						
Clury	12 Mar. 1856	19	2 roods 1 pole	in 6 hours	3 1 6	James M'Lennan, farm-servant, Caulnakyle.
Mains of Kintessack, Moy ...	4 Mar. 1856	20	½ acre	in 4 hours	4 5 0	William Royan, farm-servant, Banarack.
FIFESHIRE—						
Beath Society, Cocklaw ...	2 Jan. 1856	27	½ acre	in 7 hours	3 5 0	John Nicol, farm-servant, Shields.
Crossgates Society, Wester Bucklyvie	28 Dec. 1855	21	½ acre	in 5 hours	3 2 6	Alexander Haldane, farm-servant, Pitcorthie.
Easter Balymouth, St Andrews	25 Jan. 1856	27	½ acre	in 4 hours	4 0 0	James Leslie, farm-servant, Carngour.

LIST OF PLOUGHING COMPETITIONS (*continued*).

District.	Date.	No. of Ploughs.	Extent.	Time.	Amount of Premiums.	First Premium and Society's Medal Awarded to
FIFESHIRE (*continued*)—						
Dunnikeir	12 Feb. 1856	30	½ acre	in 5 hours	£3 7 6	Andrew Elder, farm-servant, Sauchenbush.
Largo Society, Chesterston ...	28 Dec. 1855	20	½ acre Scotch	in 6 hours	3 5 6	Wm. Latta, farm-servant, Pitcruvie.
Leslie Society	2 Jan. 1856	40	½ acre Scotch	in 6 hours	4 8 0	Thomas Galloway, farm-servant, Strathendry.
North-Eastern District, Gask ...	4 Jan. 1856	32	½ acre	in 6 hours	4 6 6	Andrew Collier, farm-servant, Muirton.
INVERNESS-SHIRE—						
Pitmain	12 Mar. 1856	35	Rate of 1 acre	in 10 hours	10 0 0	John Cameron, farm-servant, Belleville.
Wester Moniack, Kirkhill ...	14 Feb. 1856	47	½ acre	in 5 hours	8 0 0	Donald Gordon, farm-servant, Wester Moniach.
KINCARDINESHIRE—						
Banchory-Devenick, Mains of Portlethen	18 Dec. 1855	41	Rate of 1 acre	in 9½ hours	8 0 0	John Mackie, farm-servant, Portlethen.
Darnford, Durris	4 Dec. 1855	44	Rate of 1 acre	in 10 hours	7 15 0	Wm. Brebner, Mill of Blairydruie.
Fettercairn Club, Balfeigh ...	1 Dec. 1855	52	⅓ acre Scotch	in 4½ hours	8 3 0	James Low, farm-servant, Bogmuir.
Maryculter, Mains of	12 Feb. 1856	27	½ acre	in 5 hours	4 4 0	Samuel Brown, farm-servant, Millbank.
Maryculter, Whiteside ...	2 Jan. 1856	27	½ acre	in 5 hours	3 9 0	George Taylor, farmer, North Rothnick.
Strachan, Gateside	1 Jan. 1856	29	Rate of 1 acre	in 10 hours	5 9 6	James Stuart, farm-servant, Bowbutts.
KIRKCUDBRIGHT—						
Low-Hardland, Balmaclellan ...	25 Jan. 1856	17	1 rood	in 3½ hours	6 6 6	William Cuthbert, farmer, Hill.
LANARKSHIRE—						
East Kilbride Society, Mains and East Rodgerston	29 Jan. 1856	26	Rate of 1 acre Sc.	in 17 hours	8 0 0	John Morrison, Milton.
Newhouse	14 Feb. 1856	17	59 poles	in 3 h. 41 m.	4 2 6	David Prentice, Whitelees.
LINLITHGOWSHIRE—						
Whitburn Society	12 Feb. 1856	19	Rate of 1 acre	in 10 hours	3 5 0	Alexander Russell, Dales.
Newliston	12 Feb. 1856	36	½ acre Scotch	in 7½ hours	4 17 6	Peter Gray, farm-servant, Lanton.
NAIRNSHIRE—						
Holm	13 Nov. 1855	29	70 poles	in 5 hours	4 7 6	William Bruce, farm-servant, Drumduan.
ORKNEY—						
Elwick Bank	8 Feb. 1856	31	½ acre	in 4½ hours	3 7 0	James Wilson, farm-servant, Strathore.

LIST OF PLOUGHING COMPETITIONS (*continued*).

District.	Date.	No. of Ploughs.	Extent.	Time.	Amount of Premiums.	First Premium and Society's Medal Awarded to
PERTHSHIRE—						
Acharn, Kenmore	28 Mar. 1856	19	65 poles	in 6 hours	3 0 0	James M'Gregor, Aberfeldy.
Boreland, Lochtayside ...	21 Mar. 1856	25	81 poles	in 8 hours	3 0 0	John Irvine, Duneaves.
Croftness, Aberfeldy	20 Mar. 1856	18	58 poles	in 6 hours	3 0 0	Robert M'Dougall, Croftcour.
Garvock	3 Jan. 1856	24	½ acre	in 6 hours	3 0 0	James Scott, Muirhead.
Harperstone	8 Jan. 1856	24	⅓ acre Scotch	in 4½ hours	3 0 0	Peter Sharp, Blueton.
Invervuch	10 Mar. 1856	15	Rate of 1 acre	in 10 hours	5 1 0	Duncan Robertson, Strowan.
Kirktonlees	19 Feb. 1856	15	83 poles	in 5 h. 12 m.	3 12 0	Wm. Taylor, farm-servant, Cornhill.
Logie and Lecroft Society, Keirfield	14 Feb. 1856	21	Rate of 1 acre Sc.	14 to 16 hrs.	3 3 6	John Stirling, Keir.
Methven Society, Upper Cairnie	13 Feb. 1856	34	2 roods 26 poles	in 6 h. 10 m.	4 10 0	William Storer, farm-servant, Cultmalindie.
Monzievaird & Strowan Society, Lawers	22 Feb. 1856	20	½ acre	in 7¾ hours	3 7 6	David Harley, Strowan.
Moulin Society, Edradom ...	6 Mar. 1856	21	Rate of 1 acre	in 10 hours	3 7 0	Donald Fergusson, Dalcapon.
St Martins Society, Gardrum ...	19 Feb. 1856	26	½ acre Scotch	in 6 hours	5 0 0	James Richardson, farm-servant, Rosemount.
Tirinie	26 Feb. 1856	30	½ acre	in 5 hours	3 8 0	John M'Gregor, Aulich.
Weem	7 Mar. 1856	22	½ acre	in 5 hours	4 7 0	Alexander Small, farmer, Carse.
RENFREWSHIRE—						
Renfrewshire Society, Knock ...	15 Feb. 1856	47	1 acre Scotch	in 18 hours	7 0 0	William Watson, Sheeppark, Eastwood.
ROSS-SHIRE—						
Melbost, Lews	17 Jan. 1856	15	¾ acre	in 7 hours	3 0 6	Donald Gunn, farm-servant, Melbost.
ROXBURGHSHIRE—						
Union Society, Stodrig ...	12 Feb. 1856	52	¾ acre	in 6 hours	16 3 0	John Rutherford, farm-servant, Nottylees.
SELKIRKSHIRE—						
Selkirk Club, Sunderland ...	13 Feb. 1856	31	½ acre	in 6 hours	4 15 0	William Moffat, farm-servant, Bridgeheugh.
STIRLINGSHIRE—						
Blairdrummond and Ochtertyre Society	12 Feb. 1856	37	Rate of 1 acre Sc.	in 16 hours	4 14 0	James Ferguson, farm-servant, Cambusdrenny.
SUTHERLANDSHIRE—						
Culmaily	15 Feb. 1856	52	Rate of 1 acre	in 10 hours	10 5 0	Wm. Smith, Cyderhall.

FINGER-AND-TOE IN TURNIPS.

By Mr W. B. Hunter, Haugh, West Lothian.

Finger-and-Toe in turnips needs unfortunately no description; its ravages are but too well and too widely known, and are now exciting general interest and alarm. The extent of knowledge regarding the disease, however, is very limited, having been hitherto almost confined to an acquaintance with its effects; in so far as regards its cause or its cure, it is as yet involved in almost as much uncertainty as the potato disease. In 1852 the subject was remitted by the Highland Society to Professors Anderson and Balfour for investigation, and queries were circulated for the purpose of obtaining information. The facts observable in different districts were thus obtained; but the learned gentlemen by whom the inquiry was undertaken expressed themselves unable to throw much light upon it. At a late monthly meeting of the Society for discussing the cultivation of mangold-wurzel, the subject was alluded to by most of the speakers, and the importance of some fit substitute for the turnip was dwelt upon as a consideration that would force itself upon public attention, unless some method were discovered to counteract the progress of the disease. In these circumstances, having been a sufferer myself to a great extent, and having pursued a mode of treatment which has proved effective, at all events on my own farm, I willingly accede to the request of the Secretary for a statement of my experience, believing it to be the duty of every one to communicate whatever information he may possess.

For the sake of precision, I shall confine my remarks chiefly to the treatment followed and the effects observed on one field containing 16 acres, but which was formerly subdivided, as is important to note, by a wide fence, consisting of a hedge and ditch now removed.

In 1846 this field was under turnips; the variety was Swedes, and, up to the month of August, they looked unusually promising and forward. Unhealthy-looking spots at this date began to be observable up and down the field, and gradually extended till I believe there was scarcely a sound root to be found north of the old fence line, and the crop was a dead loss. Of course, I was very much puzzled by this novel invasion, but fortunately in the small portion of the field south of the fence line I found no disease existing. Lime had been applied to this part about ten years previously; the north side had probably never been limed, certainly not during my occupancy; so here were at least indications of the course to be pursued. I may mention that I was at this time convinced of the fallacy of the idea now pretty much exploded, that the presence of disease might be attributed to the too frequent

recurrence of turnip crops on the same soil, by observing that all along the line of the old fence, where the soil was of course new, the disease *first* appeared, and the plants completely vanished. Abundant confirmation on this point has since been found in the occurrence of disease after old pasture, and on fields never before under turnips.

The field then went through the usual rotation on the four-shift course, and potatoes were substituted for turnips, excepting on a portion reserved for experiments, which were conducted in the following manner: I had applied to part of it on the grass, in autumn 1848, lime at the rate of about 14 tons per acre. Preparatory to sowing the turnips, I applied lime to another portion; with the seed in the drills I applied on other portions phosphates of lime, natural and artificial; and I also tried hot lime round some of the young plants after thinning. I had chosen for trial a portion of the field where the destruction formerly had been most complete; and the result I found to be as follows: Lime applied to the young plants was quite ineffective; phosphates in the drills equally so; lime worked in whilst preparing the land very slightly beneficial; but lime applied on the grass was a thorough cure. I have since that time gone on applying lime to all the fields affected, at the rate of from 14 to 16 tons per Scotch acre, and with uniform success, excepting in one instance where accidentally a few carts of lime had been "drowned" before it could be spread, and consequently was applied in the state of mortar. The effect was most marked; all around the crop was perfectly healthy, but wherever a shovelful of the cold lime had been thrown, the roots were not worth lifting. The field I have alluded to was under turnips last year. It was limed on the grass in 1853, and accident afforded a striking confirmation of the propriety of the course I follow. The hay crop had been stacked on the ground, and the lime was applied while some of the ricks were still there, consequently the spaces occupied by them were unlimed. Two years afterwards there was an untainted crop, except on those very spaces, where there was scarcely a sound root. The effect to the eye was striking even at a distance, so great was the difference between these spots and the rest of the field, and no predetermined experiment could have been more decisive or satisfactory than was the result of this accident.

Of course it is impossible on such a subject to lay down rules for the guidance of others, the experience of different individuals in different localities being so various, if not contradictory. My own experience, however, has led me to the following conclusions: On this farm, and I think I may venture to say in this district, lime is a complete cure, and, so far as I know, the only one. The best period for applying it is to have it ploughed in with the lea, or, I should rather say, applied at that point in the rotation which will

admit of one crop intervening before the turnips are sown, thus securing a thorough incorporation with the soil, and allowing sufficient time for a beneficial effect being produced. Applied *immediately* after harvest, where turnips are to be sown, I have found it suitable enough, but generally noticed that though the crop appeared healthy, on examination the presence of disease could be detected, and I therefore much prefer an earlier application. It is essential to have the lime ploughed in in a caustic state. I have always followed the system of applying one good dose of lime in preference to two smaller ones applied at intervals, and would recommend not less than 12 tons per Scotch acre as about a proper quantity. The opposite method is, I am aware, advocated by many whose opinions are entitled to respect; but I am not aware that any experiments have been made by others with a view to settle the point; and not having instituted any myself, I cannot pretend to solve it. In these days, when lime is so expensive, and so difficult to be had at any price, it certainly interests all of us to have some more explicit information on the subject.

PROCEEDINGS IN THE LABORATORY.

By Professor Anderson, M.D., Chemist to the Society.

ON THE COMPOSITION OF SEA-WEEDS, AND THEIR USE AS MANURE.

The wrack or sea-weed thrown up on our coasts has from time immemorial been largely employed as a manure, and it is somewhat singular that, while nearly every other manure has been carefully examined, we are almost without information as to the composition of these substances. Their ash has, it is true, been frequently analysed, and some analyses made in the Laboratory were published in the Transactions several years since, but their object has mainly been to ascertain the comparative value of different species for the manufacture of kelp, and not as manure. For the latter purpose, a knowledge of the composition of the ash is so far essential, for it is obvious that they must be an important source of mineral matter; and those who believe that the farmer ought to supply only inorganic substances in his manures, may even consider such analyses as supplying all the requisite information. But if, as is held by most chemists, the organic constituents, and particularly the nitrogen they contain, are of equal if not greater importance, the determination of these substances is an element essential to the proper appreciation of their manurial value. The importance of this subject has been particularly brought under my notice by Mr Balfour of Balfour, on whose extensive estates in Orkney seaweed is largely used, and forms a very large proportion of the manure applied to the soil; and I am indebted to him for speci-

mens of the weeds in the state in which they are usually obtained and applied.

The importance of an accurate knowledge of these matters is of greater and more general importance than is commonly supposed; for the use of sea-weed, though more general there, is far from being confined to the northern parts of our island. In Cornwall, and on many parts of our eastern coast, they are very extensively employed, and in Berwickshire and East Lothian are so highly valued that a right of way to the sea, at places where they can be abundantly collected, adds considerably to the rental of a farm. In these parts of the country they are employed only to supplement other manures, and it is only on the northern and western coasts that their importance can be fully appreciated, for there there are many districts so dependent for manure upon the supply of sea-weeds that they could scarcely be cultivated without them. It would be a matter of much interest to ascertain the number of acres to which this manure is annually applied, but for this no data exist. It is worthy of mention, however, that in some districts they are carried some miles inland, the distance being limited only by the cost of carriage; and the data to be afterwards given will afford some assistance in estimating the distance to which they can be profitably transported.

Although the number of species of sea-plants met with on our coasts is extremely large, there are three which so greatly surpass all the others in bulk and abundance, as to form at all times the main proportion of the wrack which is cast on the shore. These three are the *Fucus nodosus*, *Fucus vesiculosus*, and *Laminaria digitata*. The two former are the inhabitants of shallow water, and are generally left uncovered at ebb tide; the latter is found only in deep water. From this peculiarity of these species, it follows that the latter is found most abundantly after storms, while the former can be obtained at any time, and is, in fact, occasionally collected from the rocks at low water. As, however, the wrack is commonly collected after storms, the Laminaria generally forms a very large proportion of the whole.

The mode in which the analysis was performed was very simple. The sea-weeds, as soon as obtained, were examined, and any shells or other matters adhering to them removed. A portion was then selected in such a manner as to give a fair average of the whole plant, and dried carefully at 212°, until it ceased to lose weight, and the quantity of water determined. The dry residue was then divided into two portions, one of which was used for determining the per-centage of ash, and the remainder for the nitrogen. The rest of the weed was then hung up until sufficiently dry to burn, and a large quantity incinerated in a muffle for the analysis of the ash, which was conducted in the usual way. The iodine was determined by treating the solution

of the ash with chlorine, agitating with benzol, which dissolves the iodine, and then converting it into iodide of silver, a method which is very convenient, and gives excellent results. In the *Laminaria digitata*, the stem and frond were separated, and the composition of the ash determined in each. The specimens analysed were all full-grown, and one of the Laminarias was of very large size, the stems being fully 2 inches in diameter, and of great length. We shall first give the results of the analyses, and reserve our observations for the conclusion.

Fucus nodosus.

Water,	74.31
Protein compounds,	1.76
Ash,	4.89
Fibre,	19.04
	100.00
Nitrogen,	.28

The ash of this species required to be burned for a long time, and could not be thoroughly oxidised; hence about 3 per cent of sulphuret of sodium were found in it.

Iron peroxide,	0.26
Lime,	9.37
Magnesia,	6.49
Potash,	19.56
Iodide of potassium,	0.43
Soda,	4.47
Sulphuret of sodium,	3.58
Chloride of sodium,	23.76
Phosphoric acid,	1.67
Sulphuric acid,	21.45
Carbonic acid,	6.24
Silicic acid,	0.37
Sand,	0.20
Charcoal,	1.58
	99.43
Iodine,	.33

The results, re-calculated after deduction of sand and charcoal, gave—

Peroxide of iron,	0.26
Lime,	9.60
Magnesia,	6.65
Potash,	20.03
Iodide of potassium,	0.44
Soda,	4.58
Sulphuret of sodium,	3.66
Chloride of sodium,	24.33
Phosphoric acid,	1.71
Sulphuric acid,	21.97
Carbonic acid,	6.39
Silicic acid,	0.38
	100.00

Fucus Vesiculosus.

Water,	70.57
Protein compounds,	2.01
Ash,	5.37
Fibre,	22.05
	100.00
Nitrogen,	.32

Ash.

Iron peroxide,	.33
Lime,	8.40
Magnesia,	5.49
Potash,	19.54
Iodide of potassium,	.22
Soda,	5.74
Chloride of sodium,	23.37
Phosphoric acid,	2.02
Sulphuric acid,	26.38
Carbonic acid,	2.07
Silicic acid,	.63
Sand,	1.15
Charcoal,	4.26
	99.60
Iodine,	.17

Calculated after deduction of sand and charcoal:—

Peroxide of iron,	0.35
Lime,	8.92
Magnesia,	5.83
Potash,	20.75
Iodide of potassium,	0.23
Soda,	6.09
Chloride of sodium,	24.81
Phosphoric acid,	2.14
Sulphuric acid,	28.01
Carbonic acid,	2.20
Silicic acid,	0.67
	100.00

The *Laminaria digitata* was twice examined. The first specimen was obtained late in autumn, or rather in the beginning of winter, the other in early spring. In the former specimen, separate analyses were made of both stem and frond, but in the latter the frond had been almost destroyed, and there was not a sufficient quantity for this purpose, so that the stem only was examined.

Laminaria Digitata.

	Stem.
Water,	88.69
Protein compounds,	.93
Ash,	5.46
Fibre,	4.92
	100.00
Nitrogen,	.15

Ash.

	Stem.	Frond.
Iron peroxide,	.20	.49
Lime,	7.11	7.11
Magnesia,	2.69	5.77
Potash,	5.48	11.62
Chloride of potassium,	57.63	25.94
Iodide of potassium,	1.49	2.04
Chloride of sodium,	15.09	30.02
Phosphoric acid,	2.39	2.59
Sulphuric acid,	2.20	8.58
Carbonic acid,	4.05	2.43
Silicic acid,	.32	.97
Sand,	1.27	1.58
Charcoal,	.13	.67
	100.05	99.81
Iodine,	1.14	1.56

Results calculated after deduction of sand and charcoal:—

	Stem.	Frond.
Peroxide of iron,	0.20	0.50
Lime,	7.21	7.29
Magnesia,	2.73	5.91
Potash,	5.55	11.91
Chloride of potassium,	58.42	26.59
Iodide of potassium,	1.51	2.09
Chloride of sodium,	15.29	30.77
Phosphoric acid,	2.42	2.66
Sulphuric acid,	2.23	8.80
Carbonic acid,	4.11	2.49
Silicic acid,	0.33	0.99
	100.00	100.00

Laminaria Digitata.

Second specimen of very large size.

Water,	77.31
Protein compounds,	3.32
Fibre, &c.,	8.98
Ash,	10.39
	100.00
Nitrogen,	0.53

Ash.

Peroxide of iron,	0.41
Lime,	4.19
Magnesia,	9.92
Potash,	11.02
Chloride of potassium,	23.42
Iodide of potassium,	1.11
Chloride of sodium,	17.53
Phosphoric acid,	1.59
Sulphuric acid,	6.58
Carbonic acid,	13.80
Silicic acid,	1.09
Sand,	8.37
Charcoal,	1.13
	100.16
Iodine,	0.85

The same, calculated after deduction of sand and charcoal:—

Peroxide of iron,	0.45
Lime,	4.62
Magnesia,	10.94
Potash,	12.16
Chloride of potassium,	25.83
Iodide of potassium,	1.22
Chloride of sodium,	19.34
Phosphoric acid,	1.75
Sulphuric acid,	7.26
Carbonic acid,	15.23
Silicic acid,	1.20
	100.00

A comparison of these analyses, as might be anticipated, shows no very remarkable peculiarities; on the contrary, unless we except the presence of iodine, there is nothing to distinguish them in a marked degree from land-plants, and there is a general similarity in the results of all the analyses. The most striking difference occurs in the first specimen of Laminaria, which contains a much larger proportion of water, and smaller quantity of nitrogen, than any of the others. On the other hand, the large plant which formed the subject of the second analysis of this species, greatly surpasses the others, containing 0.53 per cent of nitrogen, and upwards of 10 per cent of ash. These quantities exceed the proportion of the same elements usually found in land-plants; but we should err greatly if we assumed these to be the standard quantities. In fact, if we take the mean of the two analyses, we find that it approaches very closely to the results obtained from the other two species. The analyses, however, would seem to indicate that the Laminaria increases in value as it approaches to maturity, although it would require a much more extended series of experiments to determine this with certainty, and the fact, though interesting theoretically, would have little bearing on the practical question of the use of these plants as manures.

Setting aside minor peculiarities, such as the presence of iodine, it may be said, that so far as their use as a manure is concerned, there is little difference between sea-weeds and ordinary land-plants. Manuring with fresh sea-weeds may therefore be considered as substantially the same as green-manuring, and similar effects may be anticipated from it. We should expect to find a rapid action soon after the application of the manure, and such is in fact the effect usually observed when the weeds are applied in the fresh state. It is in this condition that they are most commonly employed in the southern and eastern coasts of the island; and it has long been matter of observation, that even when simply spread upon the surface, they disappear, and become incorporated with the soil, with singular rapidity. In the north, however, where the sea-weeds are relied upon for the main proportion of all the

manure to be applied to the soil, it is customary to accumulate large heaps, which are allowed to stand sometimes for some months, during which time they undergo a species of fermentation or putrefication, lose to a great extent their form, and are converted into a pulpy mass, with a peculiar and very disagreeable smell. A specimen of the sea-weed sent to the laboratory had fermented so strongly that the head of the small keg in which it was contained was forced out by the pent-up gases which had been generated during the decomposition. The analysis of this substance, which had been very carefully selected, so as to give a fair average of the substance in the state in which it is applied to the soil, gave the following results:—

Water,	80.44
Protein compounds,	2.85
Fibre,	6.40
Ash,	10.31
	100.00
Nitrogen,	0.45

Ash.

Peroxide of iron,	1.65
Lime,	12.75
Magnesia,	4.55
Potash,	8.97
Chloride of potassium,	6.40
Iodide of potassium,	1.18
Chloride of sodium,	15.51
Phosphoric acid,	3.23
Sulphuric acid,	4.37
Carbonic acid,	9.54
Silicic acid,	2.11
Sand,	28.75
Charcoal,	0.81
	99.82

The same, recalculated without sand and charcoal:—

Peroxide of iron,	2.35
Lime,	18.15
Magnesia,	6.48
Potash,	12.77
Chloride of potassium,	9.10
Iodide of potassium,	1.68
Chloride of sodium,	22.08
Phosphoric acid,	4.59
Sulphuric acid,	6.22
Carbonic acid,	13.58
Silicic acid,	3.00
	100.00

The principal differences in composition between this and the analysis of the individual species lies in the ash, which contains a much larger quantity of lime and phosphoric acid, and a smaller

amount of potash salts. The increase in the former, which are nearly double the highest quantity obtained from the weeds when analysed separately, I attribute to the compost containing all the small shells and marine animals usually found attached to the sea-weeds. In analysing the different species, all foreign matters were carefully removed, but the composted or half-putrefied mass was analysed exactly as it came into my possession. It is scarcely necessary to observe that shells and animal matters must increase the quantity of lime, phosphoric acid, and nitrogen; and their presence, so far from being injurious, is greatly advantageous, and in collecting the weeds, care should be taken to gather along with them every trace of animal matter which is to be found.

In estimating the value of sea-weed manure, it may be most correctly compared with farmyard manure, for both substances are of vegetable origin; and though the latter contains also abundance of animal excretions, yet even they are indirectly derived from the food of the farm animals. Hence it follows that sea-weeds, like farmyard manure, supply to the soil all the constituents of land-plants, and that in proportions pretty nearly the same as those which are to be cultivated upon it. In contrasting it with the published analyses of farmyard manure, a very remarkable similarity is found to exist in the composition of the two. Farmyard manure is found to contain, in round numbers, 80 per cent of water, and 0.4 of nitrogen. The latter, which by some writers has been considered to be above the average of ordinary farm manure, appears, therefore, to show that the sea-weeds, weight for weight, somewhat surpass that substance. Much of course will depend upon the proportion of the different species of weeds contained in the mass applied, for a reference to the analysis of the *Fucus vesiculosus* shows that it has only three-fourths of the quantity of nitrogen which we have stated to be contained in farmyard manure. And taking this into account, it would appear probable that the average value of the sea-weed manure may, as regards the nitrogen, be taken as equal to that of the ordinary farmyard manure. Exactly the same observation applies to the inorganic constituents, which differ chiefly from those of farmyard manure in containing a smaller quantity of phosphoric acid.

The preceding observations are sufficient to show the importance of sea-weeds as manure, and perhaps may direct attention to the more careful preservation and larger employment of that which is thrown up on many parts of our coast. In the more highly cultivated districts, where artificial manures are in common use, there is perhaps some disposition to undervalue the gift which Providence casts upon our shores, and to allow it to some extent to go to waste. Indeed, it is chiefly when a severe storm throws up a large quantity just at the proper season for its application, that it is much made use of in those localities, and there is rarely any attempt

at systematic collection. On the northern coasts, and particularly in the islands, it is very different. There it is systematically collected either for kelp or for manure. Formerly, when the price of kelp was high, all the weeds which could be collected were used for its manufacture; but latterly, the price having fallen, and the fact that kelp is valued chiefly for its iodine, having restricted the manufacture principally to those weeds which contain that substance in abundance, large quantities are now available as manure. Its importance in those localities where the number of cattle is small, and the supply of farmyard manure on most farms extremely limited, cannot be over-estimated. The ease with which all sea-weeds pass into a state of putrefaction, adapts them also in a peculiar manner to a cold and damp climate, where the decay of the ordinary organic constituents of the soil is likely to be very slow. It is well known that the carbonaceous constituents of a manure are chiefly valuable because they produce by their decay a large quantity of carbonic acid, which is not only available as a source of carbon for the plants, but likewise promotes the disintegration of the mineral substances contained in the soil, and sets them at liberty in a state in which they can be taken up by the plants. The necessity for this, which exists everywhere, is doubly great in those northern districts where the prevailing soils are produced from granite and the allied rocks, which are peculiarly distinguished by their slow decomposition, and require the assistance of all the disintegrating agents it is possible to obtain.

As regards the best method of applying sea-weeds, little can be said. It is probable that the plan now in use of allowing them to lie until decomposition has commenced, and then ploughing in, is, on the whole, the best for general use. It admits of question, however, whether composting them with soil might not be in some instances attended with advantage. These, however, as well as other questions connected with their use, can be determined only in the field, and deserve to be made the subject of careful comparative experiments. Indeed, an experiment in which the sea-weeds were tried against an equal quantity of farmyard manure, and under precisely similar circumstances, would be of much value. As the quantity of phosphoric acid is not large, it is possible that advantage might be derived from the use of bone-dust or superphosphate along with the sea-weeds.

While enlarging so much on this subject, it may not be out of place to add a few words on the use of kelp as a manure, the more especially as it seems to deserve more attention than it has yet received. I have been informed by a person who has paid much attention to the manufacture of kelp, that he induced some farmers to make trial of it many years since, but that the results obtained were not sufficiently favourable to induce them to persevere in using it. The cause of this is not very apparent, unless it be that

the kelp was employed alone. Judging from the fact that it contains all the mineral constituents of plants, we should at least expect some effect from it; and probably, if combined with sulphate of ammonia or some other ammoniacal manure, it might be found useful. But I am more particularly induced to direct attention to it again in connection with the highly remarkable result obtained from the application of the muriate of potash to potatoes last season. Kelp contains nearly one-third of its weight of potash salts, among which muriate of potash (chloride of potassium) is the most abundant; and as it would prove a cheaper source of this salt than any other, it might be tried on potatoes. Of late years, kelp has been occasionally employed by the manufacturers of artificial manures as a source of alkaline salts, but the inducement to use it is merely its low price, and there is no reason to suppose that it adds to the value of these manures, but rather the reverse. This, however, does not prevent its being useful in particular cases, although it is of no advantage in ordinary artificial manures, which are bought solely for the sake of ammonia and phosphates.

COMPOSITION OF KILN-DRIED DRAFF OR BREWERS' GRAINS.

Brewers' grains—or draff, as it is commonly called in Scotland—has always been accounted a valuable food for cattle, but its use is greatly limited by the large quantity of water it contains, and its liability to become sour and unpalatable to the animals when kept for any length of time, especially in warm weather. The extent to which these circumstances bear upon its use may be easily understood, when it is known that draff, in the state in which it is delivered to the farmer, usually contains about 75 per cent of water, so that for every ton of nutriment it is necessary to transport 3 tons of useless matter. In fact, there are very few farmers who are in the position to spare horses and men to bring the requisite quantity at sufficiently frequent intervals for the supply of their stock, even when the distance is small. Hence its use has been chiefly confined to town dairies in the immediate neighbourhood of breweries, where the expenses connected with its use are to be set against those which must be incurred in the carriage of other foods from the country into the town. The consequence is that draff is generally a cheap food, especially in towns containing large breweries, and any means of reducing the cost of transport would be to extend greatly the sphere within which it could be profitably used. The idea occurred to Mr Finnie, of Swanston, that it might be possible at a moderate price to kiln-dry the grains, by which a double advantage might be gained: 1st, The cost of transport would be diminished to about one-fourth of that of the wet draff; 2d, When dry, it might be preserved for any length of time without undergoing further change,—and thus it would no longer be

necessary to bring it to the farm just at the time it is to be used, but the supplies might be obtained at any time that horses and men happened to have no other work. Mr Finnie's idea has been carried out by Messrs Berwick & Co. of Edinburgh, who have produced in the ordinary malt-kiln a very dry and easily transportable article. The question which remained to be determined was, whether any deterioration of the grains would be produced in this way. *A priori*, this was not to be expected, for all that the heat could do would be to expel the moisture, and it was no more likely that it should cause injury to the grains than to malt, which is dried in the same manner; but to settle all doubts on this point, as well as to fix the nutritive value of the article, I have made analyses of two portions of the same draff, the one before, the other after being dried. The method of analysis was the same as that made use of for any other feeding substance, and the results were:—

	Fresh.	Kiln-dried.
Water,	74.67	6.49
Albuminous compounds,	3.64	16.14
Fibre, &c.,	20.36	72.63
Ash,	1.33	4.74
	100.00	100.00
Nitrogen,	0.58	2.57

The ash contained—

Phosphates,	0.72	2.87
Phosphoric acid combined with the alkalies,	0.06	0.23

In order to contrast properly these analyses, it is necessary to calculate the composition which the wet draff would have if all the water except 6.49 per cent were expelled from it. When this is done, we obtain the following numbers—

Water,	6.49
Albuminous substances,	13.44
Fibre, &c.,	75.16
Ash,	4.91
	100.00

Here we find that the protein or albuminous compounds, on which the main value of the draff must depend, in the kiln-dried draff exceed by about 2.5 per cent those in the moist sample. This is manifestly to be attributed to irregularity in the moist sample, for it is very difficult to obtain two samples quite the same, owing to the variable proportion of husk and grain in different portions. We may, at all events, look upon these analyses as confirming the opinion that no injury is done by kiln-drying.

In estimating the value of the dried draff in comparison with other feeding stuffs, a difficulty of some importance occurs. We know that the nutritive value of all sorts of foods depends on the presence of two great classes of substances, the albuminous and

the saccharine or starchy,—the former of which supplies the waste of the muscular tissue, and is converted into flesh; the latter partly supports respiration, and is in part converted into fat. In the process of malting, the starch naturally present in the grain is changed by a remarkable chemical action into sugar, which is extracted by the mashing, and subjected to fermentation in brewing. The draff or grains which remain are therefore more or less completely deprived of their starchy and saccharine matters, while the albuminous compounds, of which the greater part is insoluble in water, are left behind. The extent to which the extraction of the saccharine matters of the malt is carried, varies with the quality of the beer produced, but is generally pretty complete, so that draff may be considered as a food deriving its value mainly from its nitrogenous compounds. If we could affix a separate value to each of these classes of nutritive matter, nothing would be easier than to define the value of the draff; but this cannot be done with any degree of certainty, for the value of any food depends on its containing a proper proportion of both, so that the balance between the two great processes of respiration and assimilation may be properly maintained. Hence it is obvious that, as these two processes must proceed simultaneously, any food which does not supply the elements required for both must be disadvantageous, because that which happens to be present cannot produce its full effect without the other. In fact, if the respiratory elements be deficient, a certain quantity of the flesh-forming constituents of the food must be diverted from their natural use, and employed to support the function of respiration for which they are not naturally fitted; and conversely, if the respiratory elements are in excess, that function is satisfied with a quantity of food incapable of supplying the necessary amount of nitrogenous matter. Although it is impossible definitively to settle the relative money-values of the different constituents of food, a hypothetical case may serve to render our meaning more apparent. Let us suppose that an animal requires equal quantities of each of these classes of nutritive matters, and that we had a food containing them in that proportion, and let us further suppose that the respiratory elements have just half the value of the flesh-forming; then, of course, one-third the value of the food in question would depend upon the former, and two-thirds upon the latter. But if this food were deprived of its respiratory elements, it would have less than two-thirds its former value, because a portion of the flesh-forming constituents would have to do duty as respiratory, and their value would consequently be reduced to the standard of the latter. According to our hypothesis, one half of the protein compounds would have to be employed in this way, so that the value of the food would be reduced to a half. We do not mean to give these numbers as at all approximating to the truth, but merely as an illustration of the mode in which the

absence of the respiratory elements in any kind of food produces a diminution in its nutritive value greater than might be at first supposed, and which it is particularly necessary to point out in the present case. It has been always held that the value of a food is to be determined mainly by reference to the proportion of nitrogenous matter it contains, and tables have been constructed by Boussingault, myself, and others, in which the value of different feeding substances has been determined in this way; and in most natural foods it is sufficiently accurate. Nature has carefully provided that, in those substances she supplies for the food of animals, the proportion of the constituents shall be such as is requisite for the proper supply of their wants, and particularly she has always provided abundance of respiratory elements, so that the determination of the quantity of nitrogenous matters affords sufficient data for a comparison of the nutritive value of such substances. But the case is greatly altered when man provides a food from which he has deliberately removed the whole or greater part of one of the great classes of nutritive matters.

I have been led to make these observations, because, if we compare the kiln-dried draff with other substances in the ordinary way, we should over-estimate its value. It contains upwards of two and a-half per cent of nitrogen, while ordinary grains do not on the average contain more than two; and hence we should at first sight be led to entertain the opinion that kiln-dried draff is more valuable as food than the grain from which it is derived, and more than half as valuable as the best oil-cake. The statements just made will suffice to show that this opinion would not be confirmed by practice, and that a considerably lower value must be attached to it. What deduction should be made in this way it is impossible to say, but it is probably considerable—indeed, even the nitrogenous matters must have a reduced value, because, of course, that part of those substances which is soluble in water must have been removed along with the sugar, and only the insoluble, and consequently less easily available proportion left behind. This, however, is a point which chemistry cannot determine; it must be done by actual feeding experiments; and an accurate series of trials with kiln-dried draff would not only be practically useful, but might be of much general importance in enabling us to arrive at some conclusions on a point regarding which we are at present very much in the dark.

COMPOSITION OF THE SEWAGE DEPOSIT OF THE EDINBURGH DRAINS.

In a paper upon sewage manure, published some years since in the Transactions, I have given a complete analysis of the sewage-water of Edinburgh, in the state in which it is used for irrigating the meadows round Lochend. I have now the opportunity of giving an analysis of the deposit formed on allowing this water to

stand in a tank, and which is applied as a manure on some of the farms in the neighbourhood—

Peroxide of iron and alumina,	4.45
Lime,	1.74
Magnesia,	0.39
Potash,	0.10
Soda,	0.06
Phosphoric acid,	1.08
Sulphuric acid,	0.16
Sand,	20.51
Organic matter,	17.95
Water,	53.56
	100.00
Ammonia,	0.93

This analysis is interesting as confirming the opinion expressed in the paper alluded to, regarding the futility of the expectation entertained by some persons of the conversion of sewage deposit into a valuable manure, capable of making us independent of guano and other foreign manures. If we estimate the value of this substance in the manner usually employed for manures—that is to say, estimating phosphoric acid at 1½d. per lb., or £14 per ton, and ammonia at 5d. per lb., or £56 per ton—it appears that the sewage deposit is worth about 13s. 6d. per ton. It contains, however, upwards of 50 per cent of water; and supposing that to be expelled by some artificial process, the residue would then be worth about £1, 7s. per ton. That this deposit may be, under certain circumstances, a valuable substitute for farmyard manure, when applied to the extent of 10 or 12 tons per acre, is obvious from the analysis, and experience has shown this to be the case. But it is equally clear that it has no claims to be considered as *portable* manure, nor is it in the least degree likely that it can ever become a substitute for guano, or other artificial manures. It may appear almost needless to refer to this subject again, after the very decided opinions expressed both by Mr Way and myself; but it would seem that the warning which chemists have given on this point has not had its full effect. Abundance of plans for "precipitating" sewage-water are constantly put forth, very frequently by persons profoundly ignorant of chemistry, and who sometimes persist in asserting that their method has met the approbation of chemists. Some of these plans, I am told, are about to be employed, and persons have been found rash enough to invest capital in a manufacture which chemistry pronounces to be certainly unprofitable. It is well, therefore, to point out, once more, that *none* of the processes recently proposed cause any *true* precipitation of sewage-water—that is to say, none of them cause substances naturally in solution in the water to become insoluble; they only act by causing a more rapid subsidence of the insoluble matters, and cannot, therefore, produce a manure of higher value than the natural

deposit, unless they be dried by some artificial process, which, however, is not at all likely to pay.

NOTE ON SOME ARTIFICIAL MANURES.

It frequently happens that substances are sent to the Laboratory for analysis, the results of which are of interest, as showing the precautions requisite in the purchase of manures. Some of these I have from time to time published in the Transactions, and I may add at present a few more, several of which are curiously illustrative of the way in which dealers attempt to mislead, by applying to their articles names to which they are in no degree entitled.

Horn-dust.—Very considerable variety occurs in the quality of this substance, owing to the intermixture of sand and other impurities. The two analyses which follow illustrate this very clearly:—

	I.		II.
Water,	8.17	...	9.85
Organic matter,	85.11	...	65.17
Phosphates,	3.58	...	3.84
Carbonate of lime,	1.15	...	4.85
Alkaline salts,	1.35		
Sand,	0.64	...	16.29
	100.00	...	100.00
Ammonia,	15.68	...	10.89

The first consists entirely of horn in a state of great purity, but the second contains 16 per cent of sand, and a much smaller quantity of ammonia. The former, reckoning the ammonia and phosphates at the usual rates, is worth exactly £9 per ton, and the latter only £6, 7s.

Red Sulphate of Ammonia.—Under this name a dark-red powder, smelling slightly of gas water, has come under my notice. It is acid to test paper, and gives off a comparatively feeble smell of ammonia when mixed with lime. Its composition was—

Water,	20.02
Organic matter,	18.85
Sulphate of ammonia,	14.67
Peroxide of iron,	6.11
Sulphate of lime,	24.94
Alkaline salts,	4.74
Sulphuric acid,	4.36
Sand,	6.31
	100.00
Ammonia,	3.78

To name a substance which contains 14 per cent of sulphate of ammonia as if it consisted entirely or mainly of that compound, is an obvious deception, by which, no doubt, many persons have been taken in. It is not worth more than £2, 2s. per ton.

Blood Manure.—Chemists and farmers, I believe, concur in un-

derstanding by this name a manure, composed chiefly or entirely of dried blood, and it bears the highest price of any manufactured manure. It is right, therefore, that it should be known that a manure is sold under that name, which is no more than a superphosphate of rather low quality, and contains an extremely small quantity of ammonia. Its analysis gave—

Water,	13.25
Organic matter,	12.26
Soluble phosphates,	10.35
Insoluble phosphates,	16.27
Sulphate of lime,	35.41
Sulphuric acid,	7.87
Alkaline salts,	0.59
Sand,	4.00
	100.00
Ammonia,	0.20

If this substance had been sold as a superphosphate, it would have been correctly named; to call it a blood manure is to mislead the purchaser, and either to induce him to pay a higher price than the actual value of the substance justifies, or to buy a manure which may not be suited to the crop to which he applies it.

THE CULTIVATION OF MANGOLD-WURZEL IN SCOTLAND.

(*Discussion at Monthly Meeting, held 26th March* 1856.)

Mr WILSON, Edington Mains, Berwickshire, said,—In a meeting like this, called for the discussion of a question previously fixed upon, and duly announced, it is a fair and natural inference that the person who opens the discussion has been selected for the duty because of some special experience which he has had in the matter about which he is to speak. He owed it, therefore, to the audience, and to himself, to state, at the very outset, that he possessed no such qualification. He had, indeed, many years ago, an opportunity of observing somewhat closely the management of the Mangold-wurzel crop, during a temporary residence in one of the midland counties of England; but his acquaintance with it as a crop cultivated on the farm which he occupied, was virtually limited to a solitary trial made last year, and that extending only to a couple of acres. As he had, however, for several years past suffered much from diseased turnip-crops, he was on that ground a fitting representative of the numerous class of farmers who must be anxious to hear of some available substitute for the turnip in cases where its growth has become precarious. It was true, no doubt, that a liberal dose of lime can in general be relied upon as an effectual antidote to the *finger-and-toe* disease, to which the turnip is now so subject; but this remedy is too costly to be resorted to unless near the beginning of an ordinary lease, and hence some cheaper and more generally available remedy is much to be desired. It seemed to him that hitherto we have sought for the remedy too exclusively in something to be applied to the soil; whereas, reasoning from the analogy of the crops, as well as from ascertained facts regarding the turnip itself, there are grounds for inferring that the evil is due, to some extent at least, to the too frequent repetition of this crop at brief intervals on the same soils. We know that, in order to obtain a good crop of red clover, we must now sow it less frequently on the same fields than could at one time be done. We know also, that in the case of grain-crops, much benefit accrues from the frequent substitution not only of one species for another, but even of varieties of one species for each other. We are told, no doubt, by some of our advisers, that we ruin the constitution of our cultivated crops in our attempts to improve them, by selecting, transplanting, hybridising, and such like, and still more by our excessive applications of concentrated manures. He did not believe in this; but certainly it was a notable fact, and one full of lessons of many kinds, that just when, by means of an improved system of drainage, better implements of husbandry, and an unlimited command of extraneous manures, we

had acquired, as it seemed, the power of increasing indefinitely the extent and weight of our turnip-crops, we should find our progress arrested, and our plans marred, by the rapid increase of a mysterious disease. It was of the utmost importance that persevering efforts should be made to ascertain the nature and causes of this *finger-and-toe* disease,* and to discover, if possible, a more available remedy for it than we at present know of; but in the mean time we had, he thought, grounds for interpreting the increased prevalence and virulence of it as a hint from nature that we are transgressing some of her laws, and that it is time for us to resort to a greater variety in our root-crops. Most of us, he supposed, had already taken the hint to this extent, that we study, in successive rotations, to alternate the Swede with the white or yellow turnip, and occasionally, also, with rape or cabbages. Considerable benefit had undoubtedly accrued from this expedient, but the palpable defect in it is, that the plants now enumerated, however much they may differ from each other in some of their qualities, are all members of one family, and hence are all liable to the same diseases, and to the attacks of the same insect-enemies. What we want, therefore, is some plant botanically unallied to the turnip, and yet capable of taking its place as regards bulk of produce, fitness for cattle-food, capacity of being stored for future use, and adaptation to our established systems of husbandry. Whatever might here be urged on behalf of the carrot, parsnip, or potato, it cannot, he thought, be questioned that the mangold-wurzel covers all these conditions more fully than any other plant with which we are acquainted. And here comes up the important question, Does the climate of Scotland admit of the successful cultivation of this plant? He was glad to say that the materials for a satisfactory solution of this question are more abundant, and more conclusive, than he was aware of, until he began to prepare for taking part in this discussion.

It had been usual with those who have treated of the cultivation of mangold-wurzel, to describe it as peculiarly susceptible of injury by frost, and, assuming that this injurious condition of the atmosphere is of more frequent occurrence in Scotland than in England, to infer and assert that, on this account, the plant cannot be cultivated with certainty of success in North Britain. He was quite aware that in the south of England crops of mangold can easily be

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* I take this opportunity of protesting against those attempts which have recently been made to innovate upon our established phraseology. Certain writers have taken it upon them to tell farmers that *anbury* is the proper name for that disease in turnips which they call *finger-and-toes*, and that the latter name should be used to signify that mere habit of growth in turnips, carrots, &c., which farmers and gardeners have hitherto indicated by saying that they were *forked*. I am much mistaken if the agricultural community do not agree with me in adhering to the old nomenclature, both as being sanctioned by long usage, and in itself more appropriate, than that which is now sought to be thrust upon us.—*J. W.*

grown of a weight per acre and general excellence, far superior to what we can hope ever to attain in Scotland; but he believed that this superiority is owing entirely to the higher range of summer heat with which the south is favoured, and not at all to its exemption from frosts. Indeed, his impression was that unseasonable frosts are of quite as frequent occurrence, and of quite as great intensity, in the south of England as they are with us. But however this may be, the fact is that the mangold can sustain with impunity a greater amount of frost than it gets credit for. In proof of this, he had to state that, in answer to numerous inquiries addressed to parties who have cultivated mangold in Scotland for many years, he had received the invariable assurance that they had never lost a crop by frost, either in spring or autumn. And his own experience, limited as it was, happily enabled him to speak decisively to this point. For in the night preceding the 17th of June last we experienced, in Berwickshire, a frost so severe, that damp clothes exposed to it were found at day-break to be as stiff as boards, shallow pools had a coating of ice, and the herbage was crisp and glistening with hoar-frost. Young potato-shoots were blackened by this low temperature. In his own case, several pieces of oats growing on muiry soil, which up to that date had a most luxuriant appearance, at once succumbed to this frost, and exhibited, during the remainder of the season, that condition which farmers call *slain*. And yet the young mangold plants escaped scaithless. Again, during the night preceding the 7th of September, the frost was so intense that whole fields of potatoes had the haulm blackened, and many a field of spring wheat had its yet milky grains frosted; but the mangold-wurzel, although its leaves were rendered flaccid at the time, soon recovered its fresh appearance, and gave proof that it had sustained no serious injury. It is true that mangold-wurzel will infallibly perish under those more intense frosts which the turnip can survive, although not without serious loss of its nutritive qualities. It is also true that a little more pains must be bestowed in storing mangold than appears to be thought necessary in the case of turnips; but this is more than repaid by the superior keeping property of the former when the necessary care *is* bestowed.

On referring for information regarding the mangold crop to those tables of agricultural statistics with which this Society is so honourably associated, and which seem destined to throw light on so many subjects, he found that last year it was grown in every county in Scotland with three exceptions—viz. Caithness, Sutherland, and Selkirk; that in two-thirds of the counties the acreage of last year exceeded that of the previous one; and that the gross increase in 1855, as compared with 1854, was 350 acres. It was farther to be noted, that this increase occurs chiefly in the counties in which mangold is most largely grown; and in particular, that

two-thirds of the increase is in the counties of Ayr and Wigtown, which betwixt them engross 1350 of the whole 2300 acres grown in Scotland—a fact which seemed fairly to warrant the inference that the crop is most esteemed where it is best known. On turning to the table which shows the rate of produce of our various crops, he found that in 19 districts the number of tons per acre set down for mangold exceeded those given for turnips; that in a good many districts they were nearly equal; and that in the remainder, the deficiency of the mangold averaged about from 2 to 3 tons per acre. In the case of Berwickshire—one of the counties in which mangold shows a higher rate of produce than turnips—he was aware that this superiority was more apparent than real, being due partly to the circumstance that the mangold, for the most part being as yet grown only in experimental plots, gets the choicest pieces of land, and these highly manured; but chiefly to the excessive prevalence of disease in the turnip crop, which rendered it necessary to state the average very low. He thought it not at all unlikely that a similar explanation could be given in regard to other parts of the county; but after making full allowance for all such modifying circumstances, it did appear to him that the statements now submitted to the meeting established the fact that there was nothing in our Scottish climate to preclude us from growing fair crops of mangold-wurzel. This being the case, it followed as a necessary consequence of the position which he endeavoured to establish at the outset of these remarks, *that it is expedient to extend the cultivation of this crop.* Let it, however, be observed that he rested this expediency, not on the intrinsic merits of the plant, great as these unquestionably are, but solely on the ground of the increasing difficulty which we experience in obtaining a healthy crop of turnips. For he was convinced that, while our comparatively moist and cool climate admits of our growing fair crops of mangold, it is yet so preeminently adapted to the full development of the turnip, that, disease apart, we shall always obtain more valuable crops of turnips than we can possibly do of mangold. In the south of England the conditions are exactly reversed, for with a hot and dry summer climate, and a prevalence of clay soils, the mangold excels the turnip there still more than the latter does the former here.

In that extended cultivation of mangold-wurzel, which, in our actual circumstances, he believed to be expedient, and expected to take place, he saw that this crop would, with us, have to contend with an element of disadvantage in addition to that one of climate to which he had just referred. Were we to grow it solely for its intrinsic merits, we should select for it our best clay loams; but as these are precisely those on which the turnip is least liable to disease, and as we propose to extend its cultivation as an expe-

dient for diminishing the risk of loss by unsound turnips, we shall inevitably be found selecting for it those fields, or portions of fields, in which we know that risk to be greatest. This superadded drawback did not, however, abate his opinion of the expediency in question, since it is better undoubtedly to have a moderate crop of mangold than a diseased one of turnips.

He had already occupied too much time to admit of his going into detail with regard to the general management of the mangold crop; nor could he excuse himself for doing so when he believed that there were many gentlemen present who would give the benefit of their valuable opinion on these practical details. To one point only would he refer, viz. the mode of depositing the seeds in the ground. Like most Scottish farmers he must confess to a strong aversion to those tedious methods of dibbling and dropping the seeds by hand which are usually recommended in the sowing of this crop. There is, however, no reason why this operation should not be performed with the same celerity and precision to which we are accustomed in the sowing of turnip-seed, and that too by means of a slight modification of the machines which we use for the latter purpose. He knew, for example, that where the old-fashioned revolving canisters with perforated belts are in use, all that is needed is to provide spare canisters, with holes wide enough to pass the large rough seeds of the mangold at the rate of from 6 to 7 lb. per imperial acre. As these seeds require to be kept near the surface, it is advisable to remove the hind rollers, and to trust to the falling in of loose soil after the passage of the coulter, for a sufficient covering to the seeds. From what he could learn he was disposed to think that the water-drills, which are now getting into good repute in England, are superior to all other machines for sowing the seeds of the mangold-wurzel.

With regard to the disposal of the mangold crop, he should also limit his remarks to a single point, and that suggested by the specialty of the circumstances under which it seems advisable that we should extend its cultivation. It is well known that to avoid the risk of injury by frost, the mangold crop should be stored about the end of October. It is also known that, unlike the turnip, it is when newly pulled neither so wholesome, so palatable, nor so nutritious as it becomes after it has lain for some months in the store-heap. In short, one of its most marked good qualities consists in its peculiar adaptation for spring use. If, then, we can succeed in growing fair crops of it on our light turnip-soils, it occurred to him that the best way of using it would be to store it on the ground where it grows, by throwing the roots together into heaps of about a ton each, sprinkling over these heaps either the leaves of the crop or a little straw, and then covering them carefully with a good coating of earth. In March and April the roots could be sliced and eaten on the ground by hoggets, and a

mangold-würzel crop would thus become out and out a substitute for a turnip one.

Mr Wright, Hedderwick Hill, East Lothian, said—He had much pleasure in adding his experience on the growing of mangold-wurzel, as hearing statements from members farming in different districts, and comparing them, was the true method of arriving at facts on subjects of agricultural importance.

Last season (1855) he grew five imperial acres, and, he might mention, his farm was situated on the sea-coast, near Dunbar. The crop was sown after wheat (on the turnip rotation), and manured in the autumn of 1854 with farmyard dung to the extent of 30 tons per acre, which was deeply ploughed in. The spring management was similar to that of preparation for turnips, and when the land was drilled, special manures, to the extent of 6 cwt. per acre, were applied,—viz. 3 cwt. Peruvian guano, and 3 cwt. dissolved bones; the seeds were dibbled in by women, 15 inches apart, and the drills were 28 inches wide. Three kinds of mangold were sown on the 2d of May (*Orange globe*, *Red globe*, and *Long red*), and the subsequent cultivation by horse and hand hoe, the same as for turnips. From some of the seeds having been deeper sown than others, and not germinating, it was necessary in the middle of June to fill up the blanks, which was done by transplanting some of those thinned out, and with the exception of the transplanted ones not attaining the same size as those sown, they answered very well, as they grew to a tolerable size, and filled up the land. It has generally been found in Scotland that mangold is apt to shoot or run to seed, and it was found in this case to do so to the extent of nearly one-sixth of the whole crop. One portion of the shot ones was pulled up during summer and given to pigs, the other portion was allowed to remain, but the stems were cut off.

Towards the end of November the crop was taken up and stored, previously to which, however, the produce of three or four spaces of 12 yards square was carefully weighed, the roots being prepared in the same state as for storing, topped, and the earth shaken off, and the average weight of the crop being 30½ tons per imperial acre, or 37 tons per Scots acre. In storing them, no knife was allowed to touch them, the leaves being screwed off and the roots shaken, so as not in any way to wound the plant; they were then carted to the steading, and carefully piled (as carrots are), part being covered with straw without earth, part with earth alone, and part with straw alone. It was found that the best method of keeping was a good covering of straw, with, in the course of a few weeks, earth put on the top; in fact, as potato-pits are made.

Towards the middle of February a commencement was made on

the pits, for ewes and lambs, giving the roots gradually, in case of scouring the sheep; and he considered that a much greater flow of milk is obtained from mangold than from swedes or turnips. Comparing it with swedes, as to the weight per acre, it was found that 10 tons more of the former were grown, but it is doubted if anything like the same amount of feeding properties are obtained for the great extra weight; still in his district it might be advisable every season to apportion a part of the turnip-break to mangold.

In conclusion, he might remark, that he prefers the *Orange globe*, as being less stringy than the long-red, and much larger than the red-globe. At the local show of roots at Haddington last December, specimens of mangold were exhibited,—those from Hedderwick Hill, under the above management, weighing 18 lb. each, while some grown by Mr Dun, Tranent Mains, under a system of irrigation, weighed 24 lb. to 26 lb. each.

Mr R. Scot Skirving, Camptoun, East Lothian, said—The interest which, for a good many years, he had taken in the cultivation of mangold-wurzel, induced him to say a few words on the subject. Observing how very frequently the turnip crop is exhausted during spring, while frost or cold east winds too frequently retard till June a full supply of fresh vegetable food, and thinking how this deficiency could be best supplied, his attention was turned to mangold-wurzel, which seemed to be well adapted for the purpose.

English farming had proved the great capabilities of this root, its nutritive properties, and its vast superiority over the turnip as regards keeping, whilst the fact that he had once seen a very heavy crop growing in East Lothian, proved that, in favourable situations at least, there was no absolute barrier to its successful cultivation in Scotland.

He therefore—though on a very small scale—began to sow some mangold every year, and as a corroboration of what Mr Wilson had said of the increased cultivation of the root, he might mention, that having at first gained premiums given by this Society, and those which the East Lothian society (at his own suggestion) annually offer, he now found himself lost in a crowd of competitors, by several of whom, such as Mr Dun of Tranent, he was completely distanced.

Like the previous speaker, he had tried most varieties of the mangold, and had found the orange-globe and the long-red the two best, though the latter is still more liable than the former to that most formidable of all the evils we have to contend with in the cultivation of the root, viz. running to seed. The mangold should be sown during the last days of April or beginning of May, the seed being barely covered with soil; and to prevent blanks, and the

better to permit the removal of plants that early threaten to shoot, he thought the seeds should be strewn continuously along the drill, and not dibbled in. With regard to storing the roots, they should be removed in November, before hard frost had set in, and they should be treated in the same manner as potatoes, being covered with earth as well as straw. He once lost a great many roots from the want of earth, the frost penetrating completely through a double covering of straw. He could not approve of Mr Wilson's suggestion that they should be stored in heaps on the field where they grew, because, by so doing, the ground could not be at once ploughed up, and thus one of the advantages of the crop would be lost, viz. its early removal permitting wheat being sown after it in autumn.

The mangold must not be used till it has been some months kept. In autumn and early winter it does not seem to be wholesome food, but after it has been three or four months in the pit it may be freely used, and in spring it becomes invaluable for cows, and for ewes and lambs. The mangold is an expensive crop, costing more trouble, and requiring more advantages of soil and climate than the turnip. He feared, therefore, that it cannot be looked to it as a substitute, to any large extent, for that crop in Scotland; but as a highly useful, indeed as an invaluable supplement and addition to the stored food for stock, he thought mangold-wurzel worthy, in an eminent degree, of the attention of agriculturists.

Mr Elliot, Hardgrave, Dumfries, said—The Lockerbie Farmers' Club having been alluded to by the chairman, and his name mentioned in connection with it, he might mention that three years ago the Club, noticing the gradual increase of the disease, finger-and-toe, in the turnip crops of the district, considered it would be advisable for a number of the members to try the cultivation of mangold as a substitute, in the event of the disease becoming more destructive. This was done; and that year he selected a field, composed of various descriptions of soil, for the experiment, the upper end of the field having been moor, at no distant period, with a black surface, but now drained and reclaimed. The middle portion of the field was light turnip-soil, the under end being deeper and of better quality. The spring was cold and barren, and the turnips, Swedish and white, which were sown on the same field as a trial against the mangold, were destroyed by frost, and had to be resown; the mangold plants were injured by the frost also, but stood it better than the newly brairded turnips. The crop of mangold when pulled was weighed, and the average of the eight acres sown was from twelve to fourteen tons per acre, the better class of land being fully sixteen tons; the turnips were also weighed, and the Swedes were fully twenty-five tons. From this experiment, and from general observation in other fields, and also from hearing the

opinion of the Club on the subject, he felt satisfied that in counties adapted for the cultivation of turnips, and on inferior soils, mangold cannot be raised to yield the same profit as turnips, but on good land, lying low, that mangold can be profitably cultivated; and especially he was convinced that in all districts where the soil is good, and a small amount of rain falls, and wherever turnips suffer by the finger-and-toe, it is advisable to grow a portion of mangold annually, not only for giving to ewes in the end of spring, or to other stock, as, when properly stored before the end of October, it keeps well into the beginning of summer, but also to lessen the quantity of turnips sown, land upon which turnips has been often repeated being found most liable to disease.

Mr Scott, Craiglockhart, Mid-Lothian, said—He had grown mangold-wurzel as a crop for four years, and that the best test, as to his opinion of its value, was the fact that he had each year doubled the extent. He had great difficulty in preventing it running to seed, and did not feel certain that late sowing was a preventive. He had last year found Skirving's seed less liable to this disadvantage than any he had before tried. He was quite satisfied that the long-red and the orange-globe were the best varieties. His practice was to prepare the land as if for turnips, and to run his turnip-barrow along the top of the drill to make a bed. He steeped the seed from thirty-six to forty-eight hours, dropped in two or three seeds at intervals of twelve inches, and passed a light roller over the top of it. Transplanting had never succeeded with him, for although the plants grew, the roots were so small as to be worthless. As to storing, he found that they kept best when covered with earth alone. He had never lost any by frost, whether earth or straw was employed, but with earth they came out fresher. In one application of the root he had been much disappointed—he alluded to its deficiency in butter properties as food for dairy cows; but nothing could excel it for cattle, pigs, and milking ewes, and it had the advantage of keeping during the whole summer.

Mr Finnie, Swanston, Mid-Lothian, said, that it was now a good many years since he had the honour of being at Holkham, during the lifetime of the late Earl of Leicester, when, by the kindness of that nobleman, he had an opportunity of observing the mode of cropping then practised on that estate. What particularly struck him were the large and magnificent crops of mangold, and when he returned home, it was with the determination to introduce that root extensively into his own turnip-break, provided he was as successful in its cultivation as the Norfolk farmers. In his first attempt, however, he was mortified to find so many plants running to seed; thinking, however, that some kinds would be less liable to do so than others, he next season procured samples

of nearly all the different varieties; but still he found that all had the same tendency, and therefore concluded that it was not so profitable a crop for him to grow as the turnip. He should observe, however, that his attempt to grow it was at an elevation of 600 feet above the level of the sea, and the disease of finger-and-toe was then unknown upon his farm. For some years back, however, his attention had been directed to very good crops of mangold grown by Mr Gibson, Woolmet, and Mr Scott, Craiglockhart, and he was now disposed to reconsider the matter; for although these gentlemen farmed at a lower elevation, still it was possible, either in the mode of management or kinds grown, that even the disadvantage arising from his high situation might be mastered; he felt, therefore, glad that this discussion had taken place. He remarked, that in travelling abroad, and meeting, as they did, with field after field of turnips totally useless for feeding purposes, from the prevalence of finger-and-toe, and at the same time reflecting that, after all inquiry, farmers were very much in the dark as to any certain remedy, he must confess he was much impressed with the conviction, that if some root, equally valuable as the turnip to those farming in the turnip-growing districts of the country, was not obtained, the calamity from finger-and-toe would prove as dire a calamity, in such circumstances, as ever the potato disease was felt to be by those who principally depended upon the cultivation of that crop. From what he had stated, it was clear he did not intend to offer his own past experience as any guide upon the present occasion; but he might, nevertheless, contribute his mite, by quoting that of his friend Mr M'Culloch of Auchness, who had favoured him with the following particulars, and who surely made it evident that, in certain circumstances, mangold might be grown extensively, and with advantage, in Scotland; his crop, over an extent of from 70 to 80 acres, having averaged from 22 to 25 tons on the light land, and from 25 to fully 30 on superior soil.

"With regard to the mangold seed, we steep it in cold water from four to six days, by which time you will observe a chance seed beginning to germinate; it is then spread out to dry. We sowed a considerable breadth with the hand. A rut was made with the turnip-barrow, and our best young hands deposited from three to four seeds at intervals of twelve inches, at the same time covering the seeds lightly with the left hand; four smart young ones will do about an acre per day. We attached a tin box and spout to our turnip-barrow, and to a circular plate we attached small spoons, something similar to the English corn-sowing machines, and this we found to answer well to sow the mangold seed; but it takes from eight to nine pounds per Scotch acre with the barrow, whereas the half suffices with the hand. The kinds we prefer are long-red and yellow-globe; the red-globe succeeds well on some soils. We commenced sowing last season on 24th

April. If not afraid of frost injuring the young plants, I would prefer sowing it even sooner, as it is very important to have it well forward by the time the day becomes long and warm. Some say it is more apt to shoot if early, but I have not found this to be the case to any extent worth noticing. I always have part of the top cut off whenever any of the plants begin to shoot, and if this be punctually attended to the loss is not so great. I intend to manure at the rate of 25 tons of good dung—4 to 5 cwt. guano and 12 bushels of lime per Scotch acre. The mangold should be well cleaned down when singled or gone through them the second time."

Mr WILSON said he craved the indulgence of the meeting while he offered a few words in reply to some of the observations which had been made in the course of the discussion, the more so as they had reference to points which he purposely either omitted altogether or touched very briefly, out of a desire not to trench upon ground which he thought likely to be occupied by those who might follow him. Mr Skirving's objection to his suggested plan of storing and using the mangold where it grows, would be valid in the case of such soils as he doubted not he had in view; but he specially restricted his suggestion to "light turnip-soils." As on such soils a portion of the turnip crop is statedly reserved for spring food for sheep, and the land sown with barley when the sheep-fold is removed, the objection does not apply to such cases as alone were contemplated by him in offering the suggestion.

As regarded that drawback to the mangold crop to which most of the speakers referred, viz. its tendency to have a large per-centage of its plants running to seed, he begged to state that the tendency in question is in no respect due to any peculiarity in our climate, for he had occasion to know that it is experienced in England and in Holland quite as much as it is in Scotland. He believed that the best way of dealing with these faulty plants was to cut the stems over a little above the crown as often as they rise above the general level of the crop, and to store the bulbs along with the rest.

He adhered to the preference which he had already expressed for the plan of sowing the seeds of the mangold by machine rather than by hand, not only because the former was a more exact and expeditious mode than the latter, but also because he thought it better to have a continuous line of seedlings than to have them in clumps. In the former case the thinning can be accomplished by the hoe, without having recourse to the fingers, and in the process of thinning that removal of the soil from about the plants which, in common with several of the speakers, he believed to be beneficial to them, is readily accomplished. If it be true that plants

having the tendency to run prematurely to seed can be detected at an early stage of their growth, it will of course be prudent to leave a redundancy at the first thinning, and this can more readily be done with a continuous line of them than with clumps at regulated distances apart.

AGRICULTURAL DRAINAGE.

By John Lockhart Morton.

[Premium—The Gold Medal.]

It is a point generally conceded by those who are best acquainted with the science and practice of agriculture, that thorough drainage of tenacious soils is indispensable to the securing of a maximum fertility. The term "thorough drainage" is no doubt liable to be misunderstood or misapplied: some imagining that it consists principally in removing noxious stagnant water to the depth of the mere surface-soil, others regarding it as the withdrawing of all superfluous moisture, which both soil and subsoil contain, to the depth, at least, of several feet from the surface. It is in the latter sense that the term is here used; and in the following pages I shall endeavour to show that no other system of draining is deserving of the name. To combine theory with practice, as ought to be done by every one who wishes to examine into the drainage question intelligently, I propose to divide the observations which follow into two primary sections—theoretical and practical—noticing in order the main points of interest which a general consideration of the subject may demand, and thereafter illustrating the principles laid down by stating several practical examples.

I. THE THEORY OF THOROUGH DRAINAGE.

To understand the full effect that a proper system of draining should have upon a stiff wet soil, it may be well to look at the condition which it must be in previous to the carrying out of this, the first improving operation. On looking at tenacious undrained land, one observes that it is not only saturated but overflowing with moisture, the pores and interstices of both soil and subsoil being alike full.

The mechanical injuries resulting from this state of things may thus be stated. The granulated particles are so agglutinated that the circulation of atmospheric air is greatly reduced, and the unmanageableness of the soil increased in consequence. So much so, indeed, is the last-mentioned evil experienced in practice, that were it not for the presence of an excess of water, it would

sometimes be a matter of the greatest difficulty to use the plough effectively in clayey ground; and the impossibility in many instances of reducing a few inches of the surface to a tilth, even in dry weather, affords sufficient proof of the bad effects of agglutination.

But the chemical injuries entailed on any kind of land by the stagnation of water, and especially on that which is clayey in its nature, are much more serious than a merely mechanical derangement can be supposed to be. When spring weather has set in, every one knows that evaporation goes on with great rapidity, and well-drained land is necessarily first ready to receive the seed, other circumstances being equal. This early drying, however, is not the only advantage which is gained from thorough drainage. In addition to the removing of surface-moisture by a process of evaporation, which is always necessary in a greater or less degree, the sun should, as far as possible, be made to increase the temperature of the soil. In properly drained land this is actually the case, for evaporation being reduced as nearly as can be to the minimum, the sun's rays heat the surface-stratum, and it gradually communicates its elevated temperature to the layer below. It is in this way that heat descends from the surface, and warms more or less the under-strata of the ground.

Now, in undrained or badly-drained land, this is only the case to a very small extent; for, in absence of suitable underground water-channels to remove all the moisture not held in mechanical suspension, the evaporation will be nearer the maximum than the minimum. Science has demonstrated the fact that evaporation is always a source of cold. It is found, for example, that to evaporate or convert into steam any given quantity of water—even with no more than the ordinary atmospheric pressure of 15 lb. to the square inch—an enormous amount of heat is required—much more, indeed, than is generally supposed. The heat necessary to effect the vaporisation of a cubic inch of water would be sufficient to raise 5½ cubic inches from the freezing-point of 32° to the boiling-point of 212°. But the heat so expended is, to a large extent, rendered latent—that is, imperceptible to a thermometer; yet, were the vapour produced condensed again into water, the whole heat previously absorbed would be given off in a palpable form.

The amount of this latent heat, to take another illustration, is so great, that the *vapour* produced by a cubic inch of water is capable of raising the temperature of 990 cubic inches of this fluid one degree. Suppose that 22,687½ gallons of water—a quantity equal to an inch fall of rain over an acre of land—were evaporated by the sun's rays, the heat lost in the process would be sufficient to raise the temperature of the dry soil of a whole acre, to the depth of 10 inches, no less than 99 degrees. When

we consider that upwards of 20 inches of rain-fall are evaporated in many parts during a year, the enormous importance of under-drainage as a means of preventing the temperature of the soil from being lowered, cannot fail to be observed. It is true that we do not discover in drained land so great an increase in the temperature as theory at first sight may lead us to expect. But the reason is, that radiation and other agencies are constantly at work, and modify the practical results to a very large extent.

In addition, however, to the positively bad effects which necessarily follow the stagnation of water in its lowering the temperature of the soil, it also negatively prevents the rain-fall from increasing it. In summer weather the descent of rain-water into a well-drained soil not only adds to its fertility, and washes out noxious substances which the interstices contain, but in this manner an elevated temperature is communicated to the underlying strata. Rain-water, in various respects, is indeed one of our best natural fertilisers, if we will only put the soil into a suitable condition to receive all the benefits it is capable of conferring. It is usually considerably warmer than the soil, and in addition to the heating properties which it thus possesses, it contains several manurial ingredients of great value to the farmer.

According to M. Barral, an eminent French chemist, who made a series of valuable experiments in 1851-2, to ascertain the actual qualities of rain-water, it is much richer in nitrogenous ingredients than has generally been imagined.

His investigations related only to water collected at the Paris Observatory, and are therefore scarcely applicable to country districts, or even to other situations where a larger quantity of rain falls in the year; yet, in various respects, they must furnish a very accurate data on the subject. M. Barral found the monthly average of fertilising constituents in a cubic metre of rain-water to be, during the last six months of 1851, as under:—

Nitrogen, . .	8.36 grammes	=	129	grains.
Nitric acid, . .	19.09	„	=	294.7 „
Ammonia, . .	3.61	„	=	55.7 „
Chlorine, . .	2.27	„	=	35 „
Lime, . . .	6.48	„	=	100 „
Magnesia, . .	2.12	„	=	32.7 „

These figures, however, can scarcely be taken as an average of the rain-fall even at Paris for a whole year; for it appears, from further researches of M. Barral, that there are great variations in the constituents of rain-water falling at different seasons. He found, for example, that during the last six months of 1851, the rains of Paris deposited on every English acre of land 28¼ lb. of nitric acid, and 6⅝ lb. of ammonia, or what is equivalent to about 13 lb. of nitrogen; while, during the first six months of 1852, there

were deposited on each acre only 12¾ lb. of nitric acid, and 5½ lb. of ammonia, quantities which are equal to about 7¾ lb. of nitrogen.

From some experiments made by Professor Way in 1852, on rain-water collected in the vicinity of Oxford, it appears that a rainfall of 28 inches will annually deposit on an imperial acre—

	lb.			lb.
Ammonia, .	28.59	=	Nitrogen, .	23.54
Nitric acid, .	68.91	=	„ . .	17.88
			Giving a downfall of	41.42 lb. of nitrogen.

Being the result of a single experiment, Mr Way's figures are not to be relied on as a test of the quality of a whole year's rainfall, but they bear out most completely the estimates made by M. Barral. Taking the average of the English and French calculations, every acre of land receives a dressing annually of—

	lb.
Ammonia, ...	20.443
Nitric acid, ...	55.075

We have here sufficient nitrogenous matters to yield 37.82 lb. of ammonia per acre, or about as much as can be supplied by two cwt. of guano.*

While Nature is thus liberal in her gifts, it is our duty so to prepare the soil that the greatest possible benefit may be obtained from them. The first step towards this end is to carry out a system of drainage calculated to withdraw all the water not held in mechanical suspension by the particles of soil. Every kind of land has two species of pores—namely, those which, separating the particles, are termed interstitial canals, and those which, existing in the particles themselves, are the repositories proper of the moisture required to nourish vegetable life. The more numerous the interstitial canals are in a soil of ordinary quality—provided they are not so large as to prevent necessary humidity—the greater will its fertility be when properly managed in other respects. A soil both thoroughly drained and pulverised is enriched by the percolation of rain-water, and by the free admission to its pores of atmospheric air. The inorganic ingredients of the soil are impregnated with the fertilising substances in rain-water, and either retain them mechanically, or by a complete decomposition lay hold upon them chemically, thereby producing compounds capable of taking an effective part in the elaboration of cultivated plants. It is in this way that rain-water is most effectively employed as a natural fertiliser. And here we have, to some extent, an explan-

* Since the above was written, Mr Way has stated that his figures are wrong. By further researches, he has come to the conclusion that there is no more nitric acid and ammonia in the rain-water falling on an acre of land, than is supplied by 47 lb. of guano. Science suffers by contradictions of this sort; but they cannot be avoided sometimes when the subject of investigation is a difficult one.

ation of the fact that the Rev. Mr Smith of Lois-Weedon can grow wheat year after year without manure. There must be abundance of mineral matters present in the land; but rain-water not only supplies directly certain fertilising elements, but prepares the former for co-operating with them at the same time. The soil should be regarded as a filter-bed, through which all the rain that falls upon the surface ought to percolate freely, yet not with greater rapidity than the fertilising substances are absorbed and retained. If the percolation is not complete, water beginning to accumulate becomes stagnant, and noxious acids are developed. When rain falls in this case, and is mixed with the stagnant water, a mutual decomposition and reconversion of chemical compounds is the result. But the compounds so formed are generally injurious to vegetable life, and hence when a quantity of rain-water falls on land already drowned, these new ingredients have often as much influence in producing sickliness in the plants growing upon it, as the superabundant moisture can have of itself. It is well known also that stagnant water in land not only radiates heat with rapidity, but is a ready conductor of *cold* downwards, though one of the worst conductors of *heat*. We see then how, in almost every respect, excess of moisture becomes a barrier to productiveness, especially in such soils as are close in texture and extremely bibulous.

The beneficial effects which result from the circulation in the soil of atmospheric air are highly deserving of our consideration. All the interstices and pores of the soil must be filled either with water or air; and whenever a system of thorough drainage effects the removal of the one, it introduces a proportionate quantity of the other in its place. In addition to nitrogen, oxygen, and hydrogen, of which atmospheric air principally consists, it contains carbonic acid, nitric acid, carbonate of ammonia, and other gaseous compounds introduced into it by natural and artificial exhalations. As these ingredients come into contact with the elements of the soil, they must have a greater or smaller effect upon them. By a chemical decomposition; by a process of oxidation and consequent reduction; or by simple impregnation—they effect important changes on the soil. And it is by these means that organic remains, which have for a long period been lying dormant, are speedily vitalised on the removal of stagnating water. Hence the reason why wet land, rich in organic ingredients, is usually very productive for several years after being drained. Its vegetable substances absorb oxygen from the air, and, beginning to ferment, give off carbonic acid, which, in presence of moisture, is of the greatest service in decomposing the insoluble mineral matters of the soil. Apart, therefore, from the food directly supplied to plants by the fermentation of organic remains, atmospheric agency in this way, and more directly by other means, co-operates with rain-water in effecting most important changes in the constituents of cultivated ground. Indeed

many kinds of land, which are usually thought poor and of very little value, require only to be well drained and properly aërated to become highly productive under ordinary systems of management. One of the valuable effects which result from thorough drainage and complete pulverisation, even of soils more liable in some cases to be injured by drought than by rain, is that of promoting a deposition of moisture from atmospheric air, in the pores and interstitial canals of the cultivated stratum. "The power of soils to absorb water from air," says Sir Humphry Davy, in his *Elements of Agricultural Chemistry*, p. 111, "is much connected with fertility. When this power is great, the plant is supplied with moisture in dry seasons; and the effect of evaporation in the day is counteracted by the absorption of aqueous vapour from the atmosphere by the *interior* parts of the soil during the day, and by both the exterior and interior during night. The stiff clays, approaching to pipe-clays in their nature, which take up the greatest quantity of water when it is poured upon them in a fluid form, are not the soils which absorb most moisture from the atmosphere in dry weather. They cake, and present only a small surface to the air, and the vegetation on them is generally burnt up almost as readily as on sands." Soils finely comminuted to a considerable depth necessarily absorb more moisture than those that are the reverse. But ground which happens to be rich in humus or vegetable matter, has the greatest absorptive power, while magnesian soils and garden-mould are next to it in order in that respect. One thing is perfectly certain, that in every kind of land this power to absorb moisture is greatly promoted by complete drainage and improved culture, there being at all times a close relation between the increase of fertility, and that of absorption. On this point the eminent chemist already quoted remarks: "I have compared the absorbent powers of many soils with respect to atmospheric moisture, and I have always found it greatest in the most fertile soils; so that it affords *one* method of judging of the productiveness of land." Looking, then, at the whole question of thorough drainage in its theoretical aspects, we are of necessity brought to the conclusion that it must add greatly to the fertility of most soils; and the next point, therefore, which presents itself is the best depth and distance apart to make the drains, with a view to secure the greatest possible permanent results.

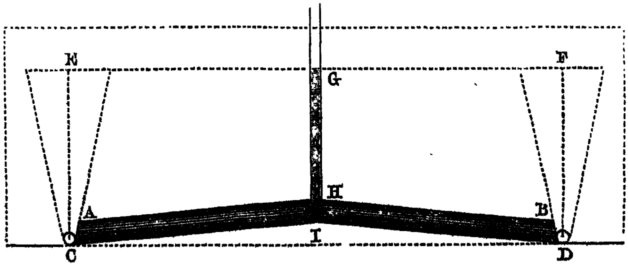
The out-and-out advocates of shallow draining, when they were numerous enough to defend their position, were accustomed to argue, that if the bed of soil in which the roots of plants ramified were properly dried, there was no necessity for any greater depth of drainage being attempted. In laying down this proposition they were propounding a self-evident truth; but an inquisitive mind will naturally ask to have the limits of the root-bed clearly defined. Stagnant water forms, in many instances, the limit as to

depth, and if the roots are obstructed by it, the growth of the whole plant must be checked, and its power to send out lateral feeders necessarily restricted. It is difficult to determine how deep the roots of most species of our cultivated plants will go, if unobstructed by noxious moisture or impenetrable layers of clay. Experience has proved that the roots of cereals will descend at least three feet into a porous healthy subsoil, and mangold-wurzel extends its fibres to a much greater distance than this. There is, therefore, no exaggeration in taking three feet as the depth to which all cultivated soils should be dried. If it is supposed that drains three feet deep will be sufficient to secure this end, the sooner the impression is given up the better. In all cases—though more in some than others—the law of capillary attraction comes into operation, and limits the action of the drains by at least 6 or 8 inches. When one puts the edge of a bit of blotting paper into water, the readiness with which it draws up the moisture by means of capillary attraction or imbibition is very instructive. Now, in the soil the very same process goes on, only the earth and clay are less bibulous than the paper, and draw up the moisture to a comparatively limited extent. The law of capillary attraction is very well observed by the introduction of water into a series of small glass tubes set on end. In the tubes which have the largest calibre—say that they are half an inch in diameter—the water will be observed to have a slightly concave surface, that on the outer edges being attracted up the sides of the tubes a little. With tubes much smaller this peculiarity will be still more distinctly seen; and with those that have so small internal openings that they only admit a fine wire, it will be found that the water will not even run through them if they are in short lengths. The whole opening is charged with liquid, but, in consequence of the attracting or retaining power of the glass walls, it is in a state of rest, and to overcome this *vis inertiæ* by natural means, we would require to add pressure from above by increasing the length of the tube, and filling it to the surface. From the nature of the interstitial canals which exist in the soil, we are justified in comparing it to an extensive series of vertical and crooked, or diagonally arranged tubes, bundled together with their mouths at the surface, and their exit openings a little above the level of the drainage channels. If the drains are shallow these tubes must of course be short, and the head pressure being less than if they were long, they will necessarily evacuate the water more slowly than would otherwise be the case. This theory is completely borne out by practical observation, for in most cases (other circumstances being equal) deep drains run sooner and faster after rain than shallow ones. And as the pores or tubes of dense soils are more minute than those of light or open land, and will therefore require to have increased head-pressure to promote free circulation of water, the

theoretical reason comes out why drains *require* to be deeper in clay land than in any other kind of soil.

Practical men are often met with, who, on the strength of some crude unphilosophic notion they have formed, will argue that if drains are made 4 feet deep in clay soils, the rain-water falling on the surface shall never reach them. No impression can certainly be more erroneous than this, and any inquiring unprejudiced mind may soon discover it to be so, if reason is only allowed to take its proper course. It is the shallow drains in clay soils that water fails to reach with sufficient rapidity, and the cause of this is very obvious. As already stated, capillary attraction, which is always greatest in small hair-like tubes, must, according to the degree of denseness of the medium through which the water is to pass, be overcome with a larger or smaller amount of vertical pressure. The power of head-pressure in water is seldom taken into account by shallow drainers. In Bramah's Hydrostatic Press we see how a very little artificial pressure on the water of a slender tube gives an enormous amount of mechanical power, and by an increase in the depth of field-drains we supply an amount of natural pressure which is of very great importance in promoting their efficiency. It is an unerring law in the mechanical properties of liquids that they exert equal pressure in all directions. From this cause a water-barrel closed at both ends may be burst by a tube of the smallest calibre being fixed in the upper end and filled with liquid. If the tube, though only say an eighth of an inch in diameter, be 3 feet in length, the compression of the liquid in the barrel will be quite as great by this head-weight as it would be with the latter carried up 3 feet, the full width. Let us see then by a little diagram how this paradoxical principle applies to the drainage of land.

Let A B C D represent a close vessel, with G H, a very small



tube closely fitted into its upper surface. If the vessel is filled, and the water in the tube brought up to the level of E F, the head-weight of the liquid, H G, will be equivalent to the pressure of a column of water whose base would be equal to the area of the bottom, C D, and whose height would be G I. In other words, the pressure of the water contained in the tube would be as great as if the whole space enclosed by the letters C D E F had been filled

with water. However shallow the vessel A B C D may be, or however small the tube G H is; or still further, however crooked that tube may be, if the height of liquid is the same, the pressure will correspond with its vertical measurement. Let it be supposed then that E F represents the surface of a drained soil, the depth of the drains being shown by two pipe-tiles, the bent line D C, that on which the water flows right and left to the tile-channel after descending the soil pores or tubes indicated by G H. According to the height of pressure between the surface and the bent line C D, the lateral flow of water must be regulated, and hence the reason why deep drains run soonest after rain. But assuming still further that the vessel A B C D represents the amount of subsoil kept wet by the power of capillary attraction to the extent of 6 or 8 inches above the drains, and that the water finds its way into the latter, principally along the bent line C D, we see how indispensable it is that drains should always be made a few inches deeper than the depth supposed to be necessary for the ramification of the roots of cultivated plants.

Whatever the amount of perpendicular pressure of the drains may be, there is one thing certain, that water cannot flow in a lateral direction towards the tile-channels in a perfectly horizontal line. To a greater or smaller extent this must of necessity reduce the depth of the actually drained soil, particularly at a considerable distance from the drains, and therefore, when the latter are far apart, the oblique lines along which the water gravitates may even reach the surface in very tenacious ground without acting on the whole superficies of ploughable soil. When drains are at too great distances from each other, the strip of undrained land which is sometimes observed half-way between them, owes its wetness to the circumstance that the oblique water-lines have run out upon the surface before meeting on either side. In consequence of overlooking the important fact that the farther we go from a drain the shallower does the really drained soil become, much money has literally been thrown away in drainage operations. It was for this reason that the system of drainage introduced by Mr Parkes was found inoperative to a considerable extent on some dense clay-soils. Nothing could properly be said against the depth he recommended, but his error lay in attributing to deep drains greater powers of lateral "suction" (if the term is admissible) than they really possessed. On the other hand, Mr Smith of Deanston, reasoning from purely mechanical principles, imagined that depth could, to a very large extent, be compensated for by the drains being placed at frequent intervals. Now that the theory and practice of drainage are more fully understood than at the period these pioneers directed attention to the subject, a union of the two systems is very generally adopted, and found perfectly

successful, while either taken by itself is sure to prove a failure in tenacious land.

Having discussed so fully the theoretical section of my topic, I proceed now to treat of drainage in its various practical aspects, premising that some of the other theories which the working out of the subject may bring to the surface will be referred to incidentally in passing, without being specially explained.

II.—PRACTICAL DRAINAGE.

In determining the mode of drainage to adopt on any particular piece of land, it is necessary not only to walk over it and inspect carefully with the eye where the natural exits are, but also to examine, by pitting or boring, the nature of the various subsoil layers, and determine their bleeding capabilities. For want of accurate theoretical as well as practical calculations before commencing drainage-works, great errors have been committed from time to time. As soon as the particular system of carrying out the operations has been determined upon, all the parts of the enclosure, about the levels of which there is any uncertainty, should be accurately gone over with a levelling instrument; and on the lines of drains in these places being pegged off, and the levels delineated on a section plan, no difficulty will be experienced by the workmen in performing the work properly. Whenever there is sufficient declivity to render it unnecessary to use the levelling instrument, the water percolating from the subsoil will keep the drainers right in respect to levels.

Outfalls and main drains.—The securing of suitable outfalls is the first department of systematic drainage. On dead flat land it is sometimes a matter of great difficulty, not to speak of expense, to obtain fall enough to admit of the main and furrow drains being made of sufficient depth. But while the efficiency of drainage-works depends in a great measure on the right formation of the discharging outlets, no reasonable amount of expense should be spared in making these as perfect as possible. In some cases it is necessary to run an open cut a long distance through the adjoining lands of other proprietors, and according to arrangement this may either be an individual or a mutual undertaking. Few reasonable landlords object to outfalls being carried through their grounds when it is found impracticable to take them in any other direction; and when a direct benefit is to be gained by both parties, the expense is in most cases mutually borne. When the cut is to be kept open, the sides should in all cases be formed with an angle of about 45°, and if the material is of a slippery nature, an angle of 40° will be deep enough. The weight of excavated material often left on the edges of open waterways, has always a tendency to make the sides slip inwards, and care should

therefore be taken to throw back the moved earthwork two or three yards from the edge of very deep outfalls. Where the cut is too deep to be left open, circular pipes of large size may be used, and to promote their discharging capacity during floods, a covering of angular unbroken stones may be laid over them. It is better, however, in most cases, rather to employ a tile of suitable size than to have recourse to a covering, the interstices of which are likely in clay soils to be filled up with silt at no distant period. To save the expense entailed by the use of large-sized wheel-thrown pipes, the plan has been had recourse to of laying a series of horse-shoe tiles both abreast and atop of each other. At best this is a very objectionable practice, and should not be adopted except in peculiar cases. If the under-rows of tiles are incapable of venting all the water during a flood, it necessarily rises into the upper tiers, and on its subsiding, a deposit of mud is left in them. In course of time the deposits made at intervals close up the top tiles altogether, and the discharging capacity of the drain is greatly reduced. But in addition to this evil there is considerable danger of even the lower tiles being gorged at a period not very distant from the time they are put into the ground. The central divisions formed by the sides of the tiles produce eddies, and sediment is thereby deposited at various points. As these little banks of consolidated mud increase in size from year to year, they obstruct the passage of the water, and the evil is thereby continually though perhaps very slowly increased, till the drain is incapable of performing its work. Now with circular pipes of the necessary size this can never be the case, for a flood scours the interior and maintains them in efficient order. Should the discharged water be of too large a volume to permit of its being confined in circular pipes of the largest calibre, it will be found of advantage to get jointing bricks made so as to afford facilities for building in dry brickwork a circular drain of any required diameter. The bricks can be cast in hand-moulds at ordinary brickworks, and when used, they form a cheaper and more efficient drain than built stonework does. The arranging of main drains so as to catch every flank in a field without adding seriously to the original cost, is a point requiring much greater judgment and skill than is commonly imagined. Larger tiles may be used than are really requisite, and money thrown away in this manner; or the tiles used may be too small, and then the drains are over-stressed, and rupture the result. In laying out the main drains and outlets, therefore, care must be taken to calculate with as great certainty as possible the quantity of water likely to be discharged. To determine the capacity in square inches of any circular pipe, square the diameter, and multiply by 0.7854. For example, a pipe having the diameter of 12 inches will, when squared, equal

144, and this, multiplied by 0.7854, will give 113.0976, or a little more than 113 square inches. The discharging power, however, of these large circular pipes is much greater than a square or horse-shoe tile-drain of equal cubical section. There is little friction in the interior, and this, taken along with the contraction of channel, gives the water a much faster current in circular than in any other kind of drains. Even in ordinary main drains, tiles of a round or a reversed elliptical section should always be preferred to those that are flat-bottomed. The flow of water in any kind of under-drains, but especially in main ones, is also greatly dependent on the accuracy with which the levels are kept; and a very slight fall, if the bottom is cleaned out with great nicety, will give a good run, when a considerable fall with inaccurately kept levels, will fail to secure this end. In cases where main drains have a long stretch without a discharging outlet, and run some risk of being flooded during heavy rains, it will be found conducive to their safety, to provide at different points, if possible, a line of pipes branching off into some adjoining open ditch, which, while too shallow to receive the discharge from the main drain itself, may yet be low enough to catch the overflow water that is likely to do harm if not allowed an exit. Suppose, for instance, that a main drain 4 feet 9 inches deep is provided with a branch pipe at intervals, laid 3½ feet under the surface, it will be obvious that the vertical pressure on the former can never exceed 15 inches; and when the nature of the ground permits of it, may be so arranged as to be a great deal less. To catch any solid matter which may be likely to get into the main drains, it is always a safe provision to form, at intervals of 180 to 200 yards, small sediment wells, with brick on bed. A depth of a foot below the level of the drain will be sufficient in ordinary cases, and the building being carried up to within about 18 inches of the surface, a flat closely-fitting stone with a ring in it will cover up the opening. Wherever there is an overflow branch-tile, there should be one of these wells in the main; and those that may be necessary at other points can have a mark set up near them, that the cover may easily be reached, and the well cleaned out at pleasure. In practice, this will be found to add greatly to the efficiency of the drains, and the expense of providing wells such as have been described is very trifling. Another provision well calculated to promote the continued efficiency of outfalls and main drains is that of providing some sort of protection at the various mouths. A grating is sometimes placed before the vent, but the water is necessarily obstructed by it to an injurious extent; and whenever drains are to be finished in the best possible manner, a light cast-iron valve, working on pivots, should be furnished for each outlet, in preference to a grating. By a number being placed on the valve, and a reference made to it in the drainage-book, there is less fear of the outlet being

forgotten than would otherwise be the case. How often, even on well-drained land, do we see the entire efficiency of the drains hazarded by the outfalls being neglected. The principal main drain is perhaps run into an open ditch, but beyond putting a turf or two round the tile, no special building is provided to mark the place. As the ditch grows up from want of attention, the drain-mouth is concealed, and by and by it becomes choked altogether, and destroys the drains. Now, if a substantial stone or brick-built mouth, in the form of a very short culvert, were in all cases put round the farthest-out tile, a little valve provided, and its exact position and everything else described in a book kept for the purpose, it could scarcely be lost sight of, except under the grossest mismanagement. Care should also be taken, in every instance that the ground at all permits of it, to give a drop of 9 or 12 inches from the sole of the outmost tile to the bottom of the open ditch. In very level ground, where the open outfall is liable to be flooded during "spates," this drop will be too little, but in ordinary circumstances, it will suffice to free the main drains from back water. Sometimes drains and outfalls laid with large tiles are seriously injured by surface water being permitted to enter in large quantities at the upper end or at some other point. Nothing is more certain to gorge up the tiles than this, and the greatest care should be taken, by diverting the water into an open ditch, to prevent the occurrence of such an evil. There is a much greater likelihood of main drains being injured by deposits at the upper end, where there is an insufficient quantity of water to clear the channel frequently, than at the lower; but throughout the whole length there is a very close connection between the mode in which the union with the furrow-drains is effected and the freedom from sediment in the main channel. If the feeding-drains run into the main almost on the same level, and at right angles to it, the current in the latter must be cut, and eddies produced, which will be likely to cause deposits at certain points. But, on the other hand, if the main drain is from 4 to 6 inches below the level of the feeders, and the ends of the latter are turned a little in the direction of the current in the former, there will be almost no obstruction to the regular flow. This end will also be gained, to some extent, by taking particular care to form apertures in the main tiles large enough to vent all the water which may be discharged by the furrow-channels. Care should be taken, however, to pack the joints so formed all round with broken bits of tiles or stones, so as to keep out moles and water-rats.

In practice it is found that the flow of water in main drains is both quickened and equalised by the admission of air at the upper ends. Every one knows that air exists in all voids which may be formed in the subsoil; but that air may be stagnant or impure, and if special ventiducts are provided at certain points, the circu-

lation they produce must, without doubt, promote the flow of water. When an outlet is observed to have a gurgling or vomiting mode of discharge, an opening made at a higher level will produce an equal current, and more water will be passed. In mains, this is an object of importance, and I hope to show in a future page that ventilation of furrow-drains is also attended with highly beneficial results in more ways than one.

The filling-up of main drains is an operation requiring great care, and involves most important results in some cases. Where thin pavement flags can be got at a nominal expense, a row of them laid along the top of the tiles forms an excellent shoulder on either side to preserve a void underneath, which may be of service during a flood; but in absence of stones of this kind, nothing is better than the largest spits of bottom clay which can be got, packed closely together, so as to form a roof of some solidity. As main drains are often run along under the furrow separating the turning ridge from the longitudinal ridges, more care is necessary with them in filling in the material, to prevent the existence of voids into which surface-water might find its way, than is required in the filling of common drains. This can easily be attended to by the larger pieces of clay being hacked down in the process of filling. After all the main-drains have been completed, they, as well as the furrow ones, should be accurately laid down on a plan, which, by being consulted at any future period, may be of great practical use.

Furrow Drains.—Amongst the first points to be considered in commencing the drainage of a field, is the determining the depth and distance apart at which the drains ought to be formed, so as to dry the land in an efficient manner. If there are springs or pent-up waters from higher levels in the land, such occasional deep drains must be laid out as will suffice to dry it; but if there are no porous strata to be tapped, then a uniform mode of draining must be adopted according to the nature of the ground. A width between the drains which would give satisfactory drainage in soils of a somewhat porous texture, would prove most defective in a dense unctuous clay; and it is the part of the person who lays out the work to ascertain, as nearly as possible, the system which will suit in the circumstances. As nothing else than general rules can be laid down here, it may be sufficient to state, that in stiff soils of the worst "bleeding" quality a width of from 18 to 20 feet between the drains will be enough. On land having a clay subsoil somewhat porous in its nature, the distance apart of 4-feet drains may be increased to 24, 30, or even 40 feet in some cases. In the majority of strong soils, however, of ordinary drawing qualities, drains that are 4 feet in depth may be placed with safety at 24 to 30 feet distances. If they are much closer than this, the expense is a good deal increased, and it is only in peculiarly re-

tentive soils that they require to be so. The widths which may be gone to in very porous gravelly subsoils cannot be taken as rules for those of ordinary texture, and a good deal must also depend on the after-treatment of the land in determining whether sparse or close drainage is most effective. Subsoiling in *dry weather* and general deep culture are known to increase the percolating powers of strong soils in a very distinct manner; while, on the other hand, if ground is lying in pasture, and old inequalities of surface left untouched, the drains, particularly when not formed in the lowest places, will not produce maximum results. It is often a waste of money to put drains into the old furrows of narrow ridges, merely for the purpose of catching the water which runs along the surface. The proper plan is to lay off the drains at such widths as the nature of the land may seem to require, and then without burying the good soil break up and level the surface to increase their action. Improvers should never lose sight of the very important fact, that rain-water ought not to run along the surface of the ground and descend into the soil immediately above the tile. Wherever the rain falls, there it should descend, and then find its way laterally to the drains on either side. Hence, in well-drained land there should be no round-backed ridges or deep furrows, but a perfectly level surface, and open furrows only of sufficient size to facilitate the convenient cutting of the crops in sections, if this be an object, as it is where hand-reaping is adopted.

The depth which drains should be made must depend, to some extent, on circumstances. If the water to be got quit of is the product of a subterraneous accumulation, very deep drains, in addition to the tapping of under strata, may be requisite to secure their being emptied, but for the removal of mere surface-water 4 feet is certainly a very suitable depth to go to. In most cases, the direction of the drain-lines should be in that of the greatest natural fall, and they ought to run parallel with each other. When carried diagonally or transversely across the face of sloping ground, the surface-water falling immediately on the lower side of any particular drain sinks into the soil, but soon oozes out upon the surface at a lower level, though not at a point sufficiently low, perhaps, to insure its entering at once into the next drain. In certain kinds of land, Mr Trimmer has shown that there are ridges and furrows in the surface of the subsoil just underneath the soil, and these usually run up and down the hill. To dry such soils, drains running obliquely across the fall are most effective, because they cut the impervious clay ridges which divide the natural furrows.

In some instances it is possible to use a drain-plough successfully in beginning drainage operations. With deep drains, however, which

generally require to be broken a great width on the surface, little advantage is gained by employing horse implements. If the ground is loose or soft, a slight saving will be effected by two strong furrows being thrown out in the line of the drain. For this purpose a strong four-horse plough, with a mould-board of great width and power, will be found of much practical service, though in some cases a heavy drain-plough, made partly of wood and partly of iron, will serve the purpose better. The efficiency of furrow-drains, as well as mains, depends very much on the accuracy with which the levels are kept by the workmen. Several kinds of levelling instruments are occasionally used to ascertain the accuracy with which the levels are kept; but when there is water present, there can be no safer means of determining this point than by employing it. As it collects in the hollows, the parts requiring to be lowered will be easily noticed; and in places where there is very little fall, a slight mud dam will determine how much there really is in any given length. Though, in one respect, it is a matter of very little consequence, whether the drains are crooked or straight, there are certain reasons for wishing them as little bent as possible. If an accurate plan of them is to be kept—as should always be the case—the line of a straight drain is easily found by getting two separate points of it. Should any part become inoperative, it is in this way readily followed out from one point to another. It is also easier to lay the tiles with closely-fitting joints in straight than in very crooked drains; and as it is more a question involving a little care than additional labour, there can be no reason for not making them straight. The cutting should also be performed with great care, the sides of the drains being kept as nearly equal in slope as possible. This may seem an unnecessary stipulation, but in slippery soils, and in rainy weather, it will not be found to be so. When the side of a drain is more or less undermined in cutting, it will necessarily slip in much readier than a properly-sloped drain will; and, besides, a badly cut drain is no cheaper than a well cut one. It will always be found of advantage to lay down to workmen a standard of excellence to which they should aspire, if they are to be constantly employed on such works. One has pleasure in going into a field of well cut drains, but the very reverse when they are all hanging to one side, and slipping in soon after being formed. Another point, in which inferior drainers are always deficient, is that of cutting the drain bottom the neat width of the pipe which is to be used. Not one amongst half-a-dozen workmen can do this; and the reason is simply to be found in the fact, that they never try it. Let it once be laid down as a fixed rule, that the pipes are to be collared by the clay material in which they are laid, and that the workmen *must* attend to this requirement, and there is no fear but it will be

attended to. The importance of having the circular pipes, or whatever other kind may be used, laid in a solid neatly formed bed can scarcely be over-estimated.

Sometimes we hear much said in favour of collars, as being of great value in keeping even 2-inch pipes in a proper line; but if we examine into the real cause of the preference shown to collared pipes, we are likely, in nine cases out of ten, to find that it originates in the facility the collars give for performing slovenly work. When a drain is cut much too wide, and not very accurately in respect of bottom levelling, nothing hides these evils more readily than collars, yet they do not cure them. The common argument in favour of collars is, that they prevent the entrance of mud at the openings. Than this impression, if it really is the origin of a valid belief, there can be no greater mistake. Surely the space left between the inside of the collars and the outside of the pipes is no less than the opening between the ends of any two carefully jointed pipes. Where there is sediment in the drains it will find its way into the pipes at much smaller openings than those which exist between the collars and pipes, and in this aspect, therefore, the former are useless. Another reason for their use is that they keep the pipe from sinking. To this it may be replied, that the bottom is very soft indeed in which equally laid and well side-packed and covered pipes can sink, and collars will not prove a remedy in these cases. An objection to the use of collars which cannot be counterbalanced by all the trivial advantages they may confer, is that of their leaving the pipes with a bossage underneath. Into the various little dams formed in the bottom of the drains by the collars, silt gradually accumulates, and on its rising to the sole of the pipes it will be very liable to do injury. From there being a bossage, the strength of the tiles is much reduced, and if a cracked one should inadvertently be put in, the superincumbent weight of earth may cause it to give way, and thereby destroy the drain. Taking everything into account, there can be no more secure and accurately formed drain than one just cut the exact width of the pipes, and neatly scooped out with a cleaner for the purpose. In good cutting clays this is easily done, but even in hard stony ground a little care will secure a neat narrow bottom. If the stones requiring to be taken out are large, the voids made by their removal may be filled up with some hard material; and a little side-packing in the laying operation will keep the pipes in their place. When the subsoil is soft, or so hard that it is impossible to keep the tile-bed the right size, then it may be advisable to use collars, but not certainly in any other case.

The kind of tiles to be used must depend to some extent on comparative prices, but, other things being equal, circular pipes are preferable to any other kind of material.

Horse-shoe tiles and soles are now rarely employed, and justly so, for they are far inferior to either circular or elliptical pipes. The latter laid with the wide end down make a very excellent drain, but are not equal to well made round pipes. In determining the sizes of pipes to be used, a calculation should be made of the probable discharge of water. When the stretch is long, the lower ends should be laid with pipes of larger calibre than the upper. With drain-lines of ordinary length 2-inch pipes will suffice at the lower ends; $1\frac{3}{4}$-inch ones in the middle, and at the upper ends they need not be more than $1\frac{1}{2}$-inches in diameter. With the latter size collars may be advisable in the event of great difficulty being felt in cutting out the channel the exact width; but in such cases it is better at once to use a larger size of pipes and lay them without collars. A considerable amount of handiness is required in laying the pipes neatly and expeditiously. Sometimes an active boy will be found to do this work far better than a man, and being agile he can stoop down much more readily. In laying a drain, the plan is to begin at the upper end, and after putting a bit of stone on the vent of the first-laid pipe, continue to lay from top to bottom. The boy walks of course on the top of the laid tiles, and in fitting the joints turns them round or selects other ones until he get them to join in a satisfactory manner. It will always be found advisable to lay the pipes as soon after the drain is cut as possible, and in this way the collection of mud is avoided. Whenever the drain, or a part of it about to be laid, is cleaned out, the overseer ought to be most careful in examining the levels, and on his being satisfied that all is right, he may authorise the laying of the tiles. After the latter operation is completed, he again inspects the drain prior to any of the excavated material being filled in. Should he observe any open joints in making this inspection, a boy accompanying him must lay a chip of stone or two upon it, and after all is found right the filling-up may be begun. The way in which this is performed varies in different districts. Some practical farmers will not be convinced that anything else than the surface sward or soil should be put next the tiles, and others will agree to nothing less than broken stones, or some similar material, to the depth of several inches. In respect to the use of soil, it may only be said that there are several disadvantages connected with it, without any material advantages. Soil is a much dirtier substance than clay, and yields by the action of water a sediment much more likely to injure the drains. The loss even entailed by its removal from the surface is something considerable, yet there is no benefit derived from its being withdrawn from its legitimate place. It does not permit water to percolate so freely through its pores as clay does, and is more stubborn in resisting the cracking tendencies of continued droughts. In regard to the use of broken stones as a covering for

pipe-tiles, nothing can be said in their favour. The impression in some districts still appears to be that they facilitate the entrance of water into the drains. For a time they may do this, but certainly not with advantage to the fertility of the soil. From the beneficial action on the soils of rain-water, as described in a bygone page, it is right surely to prevent its being withdrawn with greater rapidity than its fertilising products are extracted. On land drained with a large quantity of stones or with tiles, and a depth of a foot or so of stones on the top, there is a great tendency during heavy rains of the surface-water making large entrance-apertures above the drains. In this event the rain is not drunk in by the soil as it falls, but runs along the surface in little gutters, and entering these openings is not only lost as a fertilising agent, but is liable to carry mud into the drains and destroy them. This evil may occur at times in land drained only with pipe-tiles, but not by any means so often as with drainage-works where stones have been used. When the subsoil is of a greasy clay, the stones will very frequently be found after a number of years imbedded in consolidated mud. I have opened drains only six years put in, and found the stones used above the tiles totally gorged with mud and scratched-out earth of mole-roads. It is a great convenience for the mole to get such a fine open space for his spoil-banks as the openings between such stones; and if he can get access amongst them in search of water, in he goes at once. Grant, then, that in course of time the stone-filling becomes a pudding mass by the deposition of clay and earth, it will be obvious that, instead of serving any good end, it will only prevent percolation by being more impervious than common clay.

As water on being extracted from the soil should come into the drain in a lateral direction after it has descended the necessary depth, it is an object of some importance to have a good solid roof formed over the pipe, that there may be a slight open space left on either side to facilitate the entrance of water by the joints. For this purpose there is no covering equal to a slice or two of clay taken off the side of the drain and made to fold over the tile. The way in which this work is performed is easily stated. A man or stout boy with a sharp light digging-spade in his hand begins at one end of the newly laid drain, and pares off a slice of clay a few inches above the pipe, first on the one side and then on the other. As the one overlaps the other a little, and the lower ends of the slices are not completely severed from the side, but only broken down as if hinged to it, a solid roof of about 1½ inches in thickness is provided. During this operation the man walks on the top of the paring, and gives it all along such a pressure with the feet as his weight affords, but nothing more. Besides providing an excellent shoulder over the tile on either side, this roofing acts as a filter, and prevents the

entrance of mud. Where the clay is not soft enough to cut with the spade, the same end may be served by packing some of the lumpy pieces over the pipes, and filling up the voids with finer material. If some sort of roof like this is formed over the tiles, it does not signify a great deal how the remaining material is filled in, provided no large openings be left in it. The judicious improver will take care, of course, that very little good soil is buried. There are cases, however, particularly on peaty or "deaf" soils, where a substantial coating of clay, if it is of good quality, will do a great amount of good on the surface. In this case, soil must be allowed in exchange for clay in filling the drains. To reduce the expense of filling in the drains, it will be advisable in some cases to use a plough with a wide wooden mould-board fitted on for the purpose. By providing a long plough-tree, there is no difficulty in getting one horse to go on one side of the drain, and another on the other side. In carrying out drainage operations on dense stiff soils, it is well to ask if the ventilation of the furrow-drains as well as the mains might not add to their efficiency? I have already said that there is no lack of atmospheric air in drain-tiles, or in any other voids that may be found in the subsoil, but that air may be stagnant and possessed of noxious qualities. Even in the deepest coal-pit workings, for example, there is no such thing as an absolute void, but the air present is either frequently so much attenuated and deficient in oxygen, or so corrupted by foul gases, that its life-supporting principles and disintegrating powers are greatly reduced. In some respects drainage-conduits resemble coal-workings on a very small scale. The air present in them does not require to be possessed of life-supporting principles, except in so far as these principles are calculated by a decomposing action to rend and disintegrate the compact subsoil. But when a good circulation of atmospheric air is produced in drains by a thorough system of ventilation, a drying and cracking process is carried on through the combined action of the air at the surface and that in the drains, and in this way the bleeding powers of clay soils are immensely increased. The truth of this statement may be seen in many instances in a field which has got main drains at both ends, connected by means of furrow-drains running from one end to the other, for it is generally better drained than a similar field having the mains only at one end. The reason is that the one is partially ventilated, the other is not. When the ventilating system is to be adopted, the simplest, safest, and cheapest course is something like the following:—Along the upper ends of the drains form a drain of 3 or 4 inch pipes to act both as a water-channel and a ventiduct, and connect the common drains with it in the usual way. From this drain carry several branches across the turning ridge into the back of the adjoining fence, and finish each with a vertical shaft, made with pipes set on

end, and cover the mouth with a perforated board. If the furrow-drains are very long, there will be a difficulty in producing a circulation between end and end, and in that case a current of air may be principally kept up between the branches entering to the air-shaft, one proving an induction and the other an eduction tube. To correct this evil, it will be necessary, in some instances, to run a ventiduct across the centre of the feeding-drains, and, besides keeping its ends open, it may be well to form vertical shafts at various points along its course. When a main drain is required at both ends, the ventilation of the feeding-arteries, if they are not very long, will be abundantly provided for by a few ventiduct branches being connected with the former at different points.

As soon as a field of drains is approaching completion, the positions of the various mains and feeders should be accurately laid down upon a plan. This is easily done, but to render the plans of any real practical value, they should be prepared only from the most accurate measurements, and rarely on a smaller scale than a hundred feet to the inch. To keep all the plans together, and in an accessible form, a large book should be provided, having a leaf of drawing and writing paper alternately. On the page of drawing-paper the lines of drains in any particular field must be laid down in strong indigo or cobalt blue, on a scale to suit the size of the page. Opposite this plan, and on the page of writing-paper, the detailed dimensions of the drains should be stated, the number of tiles used, their quality and price, including cartages, the cost of cutting and filling; and the gross expense of the field, and per rod of 5½ yards of main and furrow drains respectively, being stated, the whole will be complete. By this means the proprietor is put in full possession of every interesting particular concerning his drained land, and can see at a glance, whenever he desires, the total outlay on draining. A blank space left for the purpose may be filled up in future years with notes and observations made on the action of the drains when carried out on various systems. In this way, a drainage-book, accurately kept, may become, for public as well as private purposes, a most valuable manual to be consulted by improvers of all classes.

III.—COMPLETED DRAINAGE-WORKS.

In giving an account of some drainage operations which have been executed under my care, I mean to confine my attention to two estates, and to such cases on these properties as in the absence of accurately conducted experiments were yet decided enough, from mere comparison of the growing crops, respecting the efficiency or inefficiency of the system of draining pursued. For the information of the general reader, it is unnecessary to

say where the properties are situated, or to whom they belong. It is enough for the purpose that induces me to refer to them, to state that the first to be noticed consists of several thousand acres, mostly of strong tenacious clay on the coal formation; is situated in a central part of Scotland, and has an altitude varying from 400 to 600 feet, and a cold wet climate. The second property to be referred to lies partly on the carboniferous limestone and partly on the coal-measures; is fully 800 feet above sea-level, and has a very wet, cold, fickle climate.

The system of drainage somewhat extensively carried out on the former estate, consisted for several years prior to 1847 of shallow drains in every furrow, as recommended by the late Mr Smith of Deanston, who occasionally visited and inspected the operations. At that period my connection with the improving operations was formed, and not being then so complete a convert to deep-draining as I now am, I was only desirous that the 27 to 30-inch drains should be made at least 6 inches deeper. As the proprietor was strongly in favour of shallow frequent draining, the depth could not for some years be increased to more than 30 to 33 inches. Experience, very soon acquired, however, demonstrated the fact, that while shallow drains did effect at the first a great improvement on wet land, they failed, after several years, to dry it so thoroughly as it required to be in order to grow successfully every description of field crop. Impressed with this conviction, I obtained permission in 1848 to enter on a series of experiments in draining very dense clays at different depths and distances apart. The first field drained for this purpose consisted of 16 acres of good brick-making clay. It was in pasture, covered all over with rushes, and produced scarcely any other food for stock than blue carex grasses. The enclosure was laid out in three sections, the first (No. 1), to be drained 18 feet apart and 30 inches deep; the second (No. 2), 27 feet, and 3 feet 3 inches deep; and the third (No. 3), 36 feet asunder, and 4 feet in depth. The materials used were 2-inch circular pipes at the lower ends of the drains, and 1¾-inch ones at the upper ends, all laid without collars. There were several cross main-drains, besides a principal one at the lower end. Part of the latter was laid with large open tiles and soles, but 4-inch circular pipes were chiefly employed. The work was performed in the summer season, and a double paring of good clean clay, as described in a previous page, was laid over the pipes. In filling the drains, the plough was employed to some extent, but care was taken to prevent the formation of voids. None of the surface soil was filled in, but the top spading was laid over the filling, with the red side up. The expense, irrespective of the cost of laying out the works, stood thus by the imperial acre:—

No. 1.—Deep Drains.

Cutting and filling 80 rods of 5½ yards (including main drain), at 9d.,	£3 0 0
Two-inch and other pipes, 1150 at 20s. per 1000,	1 3 0
Extra for main drain tiles,	0 5 0
Cartage and laying down of tiles, 2s. per 1000,	0 2 4
Superintendence and other contingencies,	0 2 8
Cost, per acre, of 4 feet drains, 36 feet apart,	£4 13 0

No. 2.—Drains of Medium Depth.

Cutting and filling 105 rods (including main drains), at 6d.,	£2 12 6
Two-inch and other pipes, 1540, at 20s.,	1 10 9
Extra for main drains,	0 5 0
Cartage and laying down of tiles at 2s. per 1000,	0 3 2
Superintendence and contingencies,	0 2 10
Cost, per acre, of 3 feet 3 inch drains, 27 feet apart,	£4 14 3

No. 3.—Shallow Drains.

Cutting and filling 155 rods (including main drains), at 4d.,	£2 11 8
Two-inch and other pipes, 2290, at 20s.,	2 5 9
Extra for main drains,	0 5 0
Cartage and laying down of tiles, 2s. per 1000,	0 4 7
Superintendence and contingencies,	0 3 1
Cost, by the acre, of 30 inch drains, 18 feet apart,	£5 10 1

At the time these drains were executed, wages were low, and the work was got cheaper done than it could be got completed for now. Looking at the dimensions of the different sections, it will be observed that in No. 1 the drains were too far apart for very clayey land, and even the width of the drains in No. 2 was too great for the depth. The results of this experiment may now be stated. On the land being put under oats, the crop proved most productive over the 18-feet drains, next best on No. 2, and, especially in the old furrows, very inferior on No. 1. It happened to be a damp year, and a good test was afforded in consequence. The next crop was turnips after a very deep cross-ploughing. Over the deeply-drained section the roots varied considerably, some being good and some bad. Neither was the crop on No. 2 so good as could have been wished, though better than on No. 1. The crop over the shallow drains was the best, and the land was firmer in wet weather than on the other divisions. An oat crop and then hay followed, and under both the deep drains showed that, for a distance of about 12 feet on either side, the land was thoroughly dried, but farther off than this scarcely drained at all. The

whole field is now in pasture, and the conclusion I have come to in reference to it is this, that none of the systems are satisfactory. The shallow drains did great good at first, and the deep-wrought very badly; but now, so far as the deep ones are able to draw, they are doing excellently well, but the others are not. Had I drained 24 feet apart and 4 feet deep, I have every reason to think that the drainage would have been most satisfactory. As it is, this is not the case. But one sometimes learns more from failure than from success in such operations.

Another field of about 18 acres, which I subsequently drained by desire of the proprietor 30 feet apart, and 3 feet 3 inches deep, was found to be only partially dried. From very careful inspection I have repeatedly observed that the ground is only well drained 11 feet on each side of the drain. The subsoil is very dense clay, with pieces of "till" breaking in at intervals, but is not one of the worst bleeding kinds of strong land. A few notes on different fields will be sufficient to indicate the system of drainage which has been found most successful on this property.

A field of 25 acres, a deep earthy soil, and strong yellow clay subsoil. Drains, 24 feet apart in one section, and 4 feet deep. Results most satisfactory. Another section, drained at 27 feet intervals, same depth as the other: results satisfactory, but not a great deal to be boasted of. Another enclosure, having much the same soil as the last drained, 22½ feet apart, and 3 feet 9 inches deep. Very satisfactory drainage secured. Part of a very stubborn clay field drained 32 feet apart, and 4 feet deep. Not satisfactory as to results, not more than from 10 to 11 feet being thoroughly drained on either side of the drains.

Many other instances might be enumerated; but, to save space, I may simply give a general statement of the conclusions arrived at by observation of the different modes of drainage which have been undertaken over the whole estate.

1st. Drains 30 inches deep, and from 15 to 18 feet apart, have given favourable returns, but after six or eight years they are not so effective as before, and rushes begin to come up.

2d. When the drains were only about 3 feet 3 inches deep, and 26 to 28 feet apart, they did a great amount of good, but at that depth rarely dried the clays for more than 11 feet on each side of the drain.

3d. In all cases, even in the strongest clays, 4 feet drains, if not more than from 24 to 28 feet asunder, have thoroughly stood the test of years, and given complete satisfaction.

Stone drains and tiles covered with stones have failed completely on this property after eight or ten years, and it would now be considered a waste of money to use them.

In conducting some experiments to ascertain whether deep or shallow drains would run first after rain, I obtained very curious

results, as the following figures will show. I placed a series of drains in a part of one of the worst drawing clay fields I could select. One drain was made 4 feet deep, and the next to it in succession only 2½ feet. Their lengths were the same—namely, 90 yards; and to prevent surface-water getting down above the tiles, the filled-in clay was most carefully rammed with a paving-beater. It was in dry weather the work was performed, and the mouths being all made to discharge separately into an open ditch, rain was anxiously waited for. In October it came on all at once, and it was then found that the 4-feet drains ran a considerable time before the other ones. After they had both been running a little, the discharge was measured, with the following results:—

The 4-feet drain discharged 2¼ pints in 2¼ minutes.
The 2½ " " 2¼ " 8 "

On the following day, when the rain had abated a little, the average discharge was found to be as under:—

Deep drain discharged 2½ pints in 3 minutes.
Shallow " " 2¼ " 11 "

The experiment was made in 1848, and, notwithstanding the filling of the drains, being almost puddled, they are still working well. For several years subsequent to the time that has been mentioned, the deep drains continued, after a fall of rain, to discharge a good deal more water than the shallow ones. Of late I have not had an opportunity of examining them, but have no doubt the result continues to be the same.

The drainage of the other estate, which I have now very shortly to refer to in conclusion, presents some very instructive warnings to improvers. At the time Mr Parkes directed attention to the drainage question, he was employed to advise on the draining of this property, and, under the care of a superintendent he sent, a number of fields were drained 40 to 50 feet apart, and fully 4 feet deep. The lines of the drains were sometimes laid off in the direction of the greatest fall, but often they were run obliquely across ground, sloping very considerably in one direction. By improper management on the part of the superintendent, the tiles were badly laid; and to this day they are being lifted in sections, as one rupture after another appears. After heavy outlay the drainage proved a failure in almost every field, yet the proprietor could not be prevailed upon to change the system. Having been employed in 1851 to advise in reference to the improvement of the land, I recommended a closer system of drainage, and the running of the drain-lines straight up and down the slope of the ground. Many of the fields could not be got so closely drained as I wished, but ultimately, in 1852, I found the proprietor willing to allow me to drain a 27-acre field as I might think proper. The drains were,

therefore, put in 27 feet apart, and 4 feet deep, and laid with 2-inch and 1¾-inch circular pipes. Being a strong clay, but yet tolerably porous, I expected this width to succeed satisfactorily, and I have not been disappointed. Up to the period this field was drained, turnips could scarcely be grown in wet years on any part of the property; but with drainage of this sort, root-crops of all kinds are now grown with perfect success. By-and-by the old drains will all be taken up, or supplemented by an intercalation of new drain-lines, so as to bring the width as nearly as possible from 24 to 30 feet. These dimensions have now, after several years' experience, been found to act in the most satisfactory manner, where deep and sparse drainage had proved unequal to the work. On all kinds of clay soils experience will gradually establish the fact, that these are the best possible depths and distances apart to abide by—necessary variations being made, of course, to suit the peculiarity of the subsoil. If neither shallow drains at frequent intervals, nor deep ones having large interspaces, give effective drainage on bibulous soils, let the judicious improver have recourse to a hybrid between the two—at least as to width; and if he does not then succeed, the fault will lie with himself, and is likely to have its origin in the want of proper adaptation.

PREMIUMS AWARDED AT PARIS TO EXHIBITORS AND BREEDERS OF SCOTCH STOCK.

Short-Horn Breed.

Bulls.

Thomas Sadler, Norton Mains, Ratho, for second best bull,	Silver Medal and L.36
David Park, Tynefield, Dunbar, *breeder* of do. -	Silver Medal
Anthony Cruickshank, Aberdeen, *breeder* of third best bull, exhibited by the Earl of Clancarty, Ireland, -	Bronze Medal

Cows.

James Douglas, Athelstaneford, Drem, for second best cow,	Silver Medal and L.24
Mark S. Stewart of Southwick, Dumfries, *breeder* of do.	Silver Medal
Thomas Oliver, West Fortune, Drem, for fourth best heifer,	Bronze Medal and L.16
John Haig, Cameron House, Kirkcaldy, *breeder* of do.	Bronze Medal
James Douglas, Athelstaneford, Drem, Commendation and	Bronze Medal

Ayrshire Breed.

Bulls.

Hugh Kirkwood, Killermont, Glasgow, for best bull, -	Gold Medal and L.32
John M'Onie, Laidburn, Killearn, *breeder* of do. -	Gold Medal
Daniel Craig, Polquheys, New Cumnock, for second best,	Silver Medal and L.28
Thomas Barbour, Kilensken, West Kilbride, *breeder* of do.	Silver Medal
John Stewart, Strathaven, for third best, - -	Bronze Medal and L.24
Robert Hewitson, Auchenbenzie, Thornhill, for fourth best,	Bronze Medal and L.20
James Craig, Millside, Kilbirnie, *breeder* of do. - -	Bronze Medal
Robert Porteous, Milton, Lesmahagow, for fifth best, -	Bronze Medal and L.16

Competitors could only have one Premium in each Class; a second animal, however high its merit, received commendation.

James Rennie, Kessington, New Kilpatrick, for seventh best,	Bronze Medal and L.12
Duncan Buchanan, Craigallion, Stirling, *breeder* of do. -	Bronze Medal
Alexander Dunlop, Glasgow, for eighth best, - -	Bronze Medal and L.10
Robert Mackean, Lumloch, Glasgow, *breeder* of do. -	Bronze Medal
Alexander Dunlop, Glasgow, - Commendation and	Bronze Medal
Robert Mackean, Lumloch, Glasgow, *breeder* of do. -	Bronze Medal
Alexander Oswald of Auchincruive, Commendation and	Bronze Medal
William Ritchie, Tarbolton, Ayr, *breeder* of commended bull exhibited by Dr Kirkpatrick, Glasnevin, Dublin,	Bronze Medal

Cows.

Sir Michael R. Shaw Stewart, Bart., for best cow, -	Gold	Medal and L.24
Laurence Drew, Merryton, Hamilton, *breeder* of do. -	Gold	Medal
George Gairdner, Kirklandholm, Ayr, for second best, -	Silver	Medal and L.20
Robert Kirkwood, Shankston, Maybole, *breeder* of do. -	Silver	Medal
Robert Porteous, Milton, Lesmahagow, for third best, -	Bronze	Medal and L.18
Alexander Murdoch, Hallside, Cambuslang, *breeder* of do.	Bronze	Medal
Alexander Dunlop, Glasgow, for fourth best, - -	Bronze	Medal and L.16
Alexander Graham, Summerston, W.Kilpatrick, *breeder* of do.	Bronze	Medal
Allan Pollok, Broom, Newton Mearns, for seventh best,	Bronze	Medal and L.10
Robert M'Alister, Mid-Ascog, Rothesay, for eighth best,	Bronze	Medal and L.8
James Murdoch, Carntyne, Glasgow, *breeder* of do. -	Bronze	Medal
Alexander Oswald of Auchincruive, Ayr, for tenth best,	Bronze	Medal and L.5
Sir Michael R. Shaw Stewart, Bart., Commendation and	Bronze	Medal
Mr Somerville, Fairfield Lodge, Bothwell, *breeder* of do.	Bronze	Medal
John Stewart, Strathaven, - Commendation and	Bronze	Medal
George Gairdner, Kirklandholm, - Commendation and	Bronze	Medal
William Tod, Dunure Mains, Maybole, *breeder* of do.	Bronze	Medal
Andrew Dykes, Lesmahagow, - Commendation and	Bronze	Medal
Mr Hamilton, late of Newsteading, *breeder* of do. -	Bronze	Medal
Gavin Hamilton, Auldtown, Lesmahagow, Commendation and	Bronze	Medal
John Waugh, St John's Kirk, Biggar, *breeder* of do. -	Bronze	Medal

POLLED BREEDS.

[In this Class the GREAT GOLD MEDAL was awarded to WILLIAM M'COMBIE, Tillyfour, Aberdeen.]

Bulls.

William M'Combie, Tillyfour, Aberdeen, for best bull, -	Gold	Medal and L.36
Alexander Bowie, Mains of Kelly, Arbroath, *breeder* of do.	Gold	Medal
Robert Walker, Portlethen, Aberdeen, for second best, -	Silver	Medal and L.28
Hugh Watson, Keillor, Coupar-Angus, *breeder* of do. -	Silver	Medal
Hugh Watson, Keillor, for third best, - - -	Bronze	Medal and L.24
James Beattie, Newbie House, Annan, for fourth best, -	Bronze	Medal and L.20
George Graham, Riggfoot, Dumfries, *breeder* of do. -	Bronze	Medal
The Earl of Southesk, Kinnaird Castle, Brechin, for fifth best,	Bronze	Medal and L.16
Alexander Bowie, Mains of Kelly, Arbroath, *breeder* of do.	Bronze	Medal
James Stewart, Aberdeen, for sixth best, - -	Bronze	Medal and L.12
Robert Walker, Portlethen, Aberdeen, Commendation and	Bronze	Medal
John Collier, Panlathy, Carnoustie, Commendation and	Bronze	Medal
R. B. Wardlaw Ramsay of Whitehill, Commendation and	Bronze	Medal
Adam Corrie, Cairniehill, Dumfries, *breeder* of do. -	Bronze	Medal
John Anderson, Gillespie, Glenluce, Commendation and	Bronze	Medal
Sir William Maxwell of Monreith, Bart., *breeder* of do.	Bronze	Medal

Cows.

William M'Combie, Tillyfour, for best cow, - -	Gold	Medal and L 24
The Earl of Southesk, for second best, - - -	Silver	Medal and L.20
Hugh Watson, Keillor, *breeder* of do. - - -	Silver	Medal
John Collier, Panlathy, for third best, - - -	Bronze	Medal and L.16
Thomas Collier, Hatton, Carnoustie, *breeder* of do. -	Bronze	Medal
Robert Walker, Portlethen, for fourth best, - -	Bronze	Medal and L 14
Alexander Bowie, Mains of Kelly, for fifth best, -	Bronze	Medal and L.12

William Ruxton, Farnell, Brechin, *breeder* of do. -		Bronze Medal
Trustees of the late Robert Scott, Balwyllo, for seventh best,		Bronze Medal and L.8
William M'Combie, Tillyfour, -	Commendation and	Bronze Medal
William M'Combie, Tillyfour, -	Commendation and	Bronze Medal
William M'Combie, Tillyfour, -	Commendation and	Bronze Medal
The Earl of Southesk, - -	Commendation and	Bronze Medal
James Beattie, Newbie House, Annan,	Commendation and	Bronze Medal
Andrew Dow, Brockwoodlees, Canonbie,	*breeder* of do.	Bronze Medal
The Trustees of the late Robert Scott,	Commendation and	Bronze Medal
Alexander Bowie, Mains of Kelly,	Commendation and	Bronze Medal
James Stewart, Aberdeen, -	Commendation and	Bronze Medal

Highland Breed.

Bulls.

George & J. G. Smith, Minmore, Ballindalloch, for best bull,	Gold Medal and L.32
Neill Malcolm of Poltalloch, Lochgilphead, for second best,	Silver Medal and L.28
Alex. Stewart, Dalvey, Grantown, for third best do. -	Bronze Medal and L.24
John Gordon, Ballintomb, Grantown, *breeder* of do. -	Bronze Medal
Allan Pollok of Broom, for fourth best, - -	Bronze Medal and L.20
Donald Macdonald, Monachill, Perthshire, *breeder* of do.	Bronze Medal
The Hon. Lady Menzies, Rannoch Lodge, Kinloch Rannoch, for fifth best do. - - - -	Bronze Medal and L.16

Cows.

The Duke of Sutherland, Dunrobin, Golspie, for best cow,	Gold Medal and L.24
A. and A. Stewart, Ellanreach, Alness, *breeders* of do.	Gold Medal
Allan Pollok of Broom, for second best cow, - -	Silver Medal and L.20
Mr M'Laren, Benledi, Perthshire, *breeder* of do. -	Silver Medal
John Gordon, Ballintomb, for third best, - -	Bronze Medal and L.16
The Hon. Lady Menzies, for fourth best, - -	Bronze Medal and L.12
Neill Malcolm of Poltalloch, for fifth best, - -	Bronze Medal and L.10
William Webster, Islay, for sixth best, - - -	Bronze Medal and L.8
Allan Pollok of Broom, - - Commendation and	Bronze Medal

Leicester Sheep.

Tups.

John Collie, Ardgay, Elgin, for fourth best tup,	Bronze Medal and L.12

Ewes.

George Hope, Fenton Barns, Drem, for third best pen of ewes,	Bronze Medal and L.10
John Collie, Ardgay, for third best pen of gimmers, -	Bronze Medal and L.10
George Murray, Mount Pleasant, Berwick-on-Tweed, for fourth best, - - - - - - -	Bronze Medal and L.8

Southdown Sheep.

Tups.

Robert Scot Skirving, Camptoun, Haddington, for fourth best tup, - - - - - -	Bronze Medal and L.12
James Aitchison of Alderston, *breeder* of do. - -	Bronze Medal
Robert Scot Skirving, Camptoun, for fourth best shearling tup,	Bronze Medal and L.12

Ewes.

John Hutchison of Monyruy, Peterhead, for best pen of ewes,	Gold Medal and L.12

Cheviot Sheep.

Tups.

John Carruthers, Kirkhill, Moffat, for best tup, -	Gold Medal and L.24
Thomas C. Borthwick, Hopsrig, Langholm, for second best,	Silver Medal and L.20
James Brydon, Moodlaw, Langholm, for third best, -	Bronze Medal and L.16

Thomas Elliot, Hindhope, Jedburgh, for fourth best, -	Bronze Medal and L.14
Andrew Easton, Todrig, Hawick, for fifth best, - -	Bronze Medal and L.12
William Houstoun, Kintradwell, Golspie, for sixth best,	Bronze Medal and L.10
William Patterson, Twiglees, Lockerbie, for seventh best,	Bronze Medal and L.8
James Brydon, Moodlaw, *breeder* of do. - -	Bronze Medal

Shearling Tups.

John Carruthers, Kirkhill, Moffat, for best shearling tup,	Gold Medal and L.24
Thomas Elliot, Hindhope, Jedburgh, for second best, -	Silver Medal and L.20
Donald Horne of Langwell, Caithness, for third best, -	Bronze Medal and L.16
William Houstoun, Kintradwell, Golspie, for fourth best,	Bronze Medal and L.14
Charles Hood, Inverbrora, Golspie, for fifth best, -	Bronze Medal and L.12

Ewes.

Thomas Borthwick, Hopsrig, for best pen of ewes, -	Gold Medal and L.12
Thomas Elliot, Hindhope, for second best, - -	Silver Medal & L.11, 4s.
Donald Horne of Langwell, for third best, - -	Bronze Medal and L.10
James Johnstone, Capplegill, Moffat, for fourth best, -	Bronze Medal and L.8

Blackfaced Sheep.

Tups.

John Drife, Barr, Sanquhar, for best tup, - -	Gold Medal and L.20
John Lorne Stewart, of Stronvar, Campbeltown, for second best,	Silver Medal and L.16
John Watson, Nisbet, Biggar, for third best, - -	Bronze Medal and L.14
Adam Blacklock, Minnygap, Moffat, for fourth best, -	Bronze Medal and L.12
John Mackinlay, Farmtown, Braeleny, Callander, for fifth best,	Bronze Medal and L.10
The Duke of Hamilton and Brandon, for sixth best, -	Bronze Medal and L.8
David Foyer, Knowehead, Campsie, *breeder* of do. -	Bronze Medal
Gavin Sandilands, Cumberhead, Lesmahagow, for seventh best,	Bronze Medal and L.6
John M'Laren, Monzie, Blair Atholl, for eighth best, -	Bronze Medal and L.4

Ewes.

Gavin Sandilands, Cumberhead, for best pen of ewes, -	Gold Medal and L.12
Allan Pollok of Broom, Newton Mearns, for second best,	Silver Medal and L.10
John L. Stewart of Stronvar, for third best, - -	Bronze Medal and L.8
John Drife, Barr, Sanquhar, for fourth best, - -	Bronze Medal & L.7, 4s.
John M'Laren, Monzie, Blair Atholl, for fifth best, -	Bronze Medal & L.6, 8s.
Adam Blacklock, Minnygap, Moffat, for sixth best, -	Bronze Medal and L.6
John Collier, Panlathy, Carnoustie, for seventh best, -	Bronze Medal and L.5

Seeds and Roots.

Peter Lawson and Son, Edinburgh, for a collection of seeds and roots, - - - - - -	The Great Gold Medal
R. T. Mackintosh, Edinburgh, for a collection of seeds and roots, - - - - - - -	Gold Medal
Robert Scot Skirving, Camptoun, Haddington, for a collection of seeds, - - - - -	Gold Medal
James Brodie, Linplum, Haddington, for wheat, -	Gold Medal
George Hope, Fenton Barns, Drem, for wheat, - -	Silver Medal
Robert Binnie, Seton Mains, Tranent, for wheat, -	Silver Medal
John Finnie, Swanston, Edinburgh, for Hopetoun oats,	Bronze Medal
John Brown Wright, Hedderwick Hill, Dunbar, for beans,	Bronze Medal

Implements.

Robert Law, Shettleston, Glasgow, for best farm-cart, - - -	L.5
Thomas Murray, Ellmford, Dunse, for third-best do. - - -	L.3
Robert Law, Shettleston, for harrows, Commendation and Bronze Medal	

VETERINARY DEPARTMENT.

Edited by John Gamgee,

Professor of Anatomy and Physiology in the Veterinary College, Edinburgh; Late Lecturer on Veterinary Medicine and Surgery in the Camden Hall, London.

Shortly before the death of my predecessor—the late Mr John Barlow—the Highland and Agricultural Society, eager for the advancement of veterinary science, had decided upon adding to its *Transactions* Quarterly Reports on the diseases of animals. It was not given to Mr Barlow to put into practice the plan he had conceived to meet the Society's wishes. It has been thought fit not to abandon the primary intention, though no scheme for its realisation exists at present.

With some diffidence I undertake to place before the members of the Highland Society an account of the progress that is constantly being made in veterinary science, and to tender advice and instruction on topics that bear as intimate a relation to agriculture as to the study of the medicine of brutes.

Two great evils have been said to attend the teaching of veterinary science to agriculturists. The first is, that it is sanctioning an empiricism greatly to the detriment of the veterinary profession; and, secondly, that it makes farmers trust to their own resources in the treatment of disease, only to their own loss. I can only say that I shall willingly relinquish my present project when its injurious influence shall be manifest. My time and labour shall ever be devoted, with all the zeal I am possessed of, to the supplying the wants of my profession,—wants which are, throughout Great Britain even, if possible, more real than apparent. My present aim is to widen the sphere of action with attendant good, keeping steadily in view the centre to which professional effort must converge; and until it shall be proved that the so-called protective laws which have been found incompatible with the full prosperity of the land, are applicable to the fruits of the brain, I shall persist in hoping good from extension of learning freed from all party trammels.

These observations of general application seem to bear particularly on the relation of agriculture to veterinary medicine. These have from time immemorial been considered inseparable. They have lived together in obscurity, and the link that binds them is so natural and strong, that progress in the one necessarily implies progress in the other; and they must continue to form common cause, even in this epoch of reform and learning.

In the days of ancient Greece and Rome, the most learned philosophers and statesmen, and the most valorous warriors, legislating and fighting for their countries' aggrandisement, did not disdain to instruct the tillers of the land on the cultivation of the soil,

and on the management and diseases of the dumb creatures that constituted, as they do to this day, the substantial wealth of nations.

Varro, Cato, Vegetius, even Constantine IV., and other illustrious men and princes, thought it not derogatory to lend their names or their pen to agriculture and veterinary medicine. Virgil obtained favour in the house of Cæsar by having cured many of the emperor's horses, and wisely foreseeing and announcing as to the qualities of the produce of a diseased mare and other animals, including dogs intended for the chase.

It were almost useless to attempt to trace the history of agriculture and veterinary science through the middle ages. Those who possessed animals attended to their health. Superstition and witchcraft held their sway, but it is strange that these operated perhaps more injuriously on the progress of human medicine than of veterinary science. The first was under the direct influence of Arabian errors and prejudices, but the second found refuge in greater obscurity. From Italy sprang many farriers that were engaged in the various courts of Europe, but all came from the peasantry, with the exception of but few of the most celebrated authors. In the eighth and ninth centuries, several works on agriculture emanated from Arabia, and many contained information on the diseases of animals, and bore titles accordingly. Albert of Bollstadt, Bishop of Ratisbon; Jordanus Ruffus, Great Justiciary of Calabria; Vincent of Beauvais; Jacobus Auria, Doria of Genova; Theodore, Bishop of Cervia; Pietro de Crescenzi of Bologna; and Lorenzo Rusio, were the honoured names connected with the combined agricultural and veterinary literature in the thirteenth century. In the middle of the fourteenth, Dino di Pietro Dini, a Florentine farrier, wrote a treatise on Farriery, in which he speaks of the cultivators of veterinary medicine as individuals unaccustomed to study, and dragged from the spade and from guarding sheep.*

Certain it is, that at all periods the management of animals and the treatment of their diseases have been the subject of the united attention of the highest and the lowest orders of men; but I have wished to show an interesting feature in the history of veterinary science,—namely, that its connection with agriculture has been constant and uninterrupted. Such a connection may yet, by history, be proved to have been its safeguard, for, as I have shown elsewhere, it was at a singularly early period after the revival of learning that the records of facts and sound observation formed the basis of a work on veterinary medicine by a senator of Bologna, Carlo Ruini. Ruini had as much to see and learn as, but directly less error to eradicate than, the reformers of medicine. Unfortunately this applies only to a portion of the works of this great man.

* See Ercolani, *Ricerche sugli Scrittori di Veterinaria*. 2 vols. Turin, 1851-54.

We have now to solve a very important question,—viz. What led to the establishment of veterinary colleges? The latter half of the eighteenth century is the period that will throughout all time be the most memorable in the annals of veterinary science. Agriculturists cried out most bitterly in consequence of the severe losses sustained from the cattle-plague. We find that, at the opening of Parliament on the 9th of January 1770, the first words the king uttered had reference to the serious calamity that had befallen the nation, in the spreading from the Continent to our island of this dreadful epizootic. The Lords and Commons did not turn a deaf ear to this earnest appeal, and a host of learned men, of no single profession, responded from different parts of England, and amongst them were Mortimer, Brocklesby, and the Bishop of York. Layard had written on the disease as far back as 1757.

All Europe was then in consternation in consquence of the bovine pest, that periodically extended over it from the Asiatic steppes. The haughty vanity of the most proud was curbed, and from grievous disaster the prospects of great and lasting good arose.

The Veterinary College of Lyons was founded by Bourgelat. His students successfully checked the ravages of disease, and were recognised as constituting not only a useful, but an essential body of professional men. The Agricultural Society of Paris took the initiative, offering a prize in 1765 for an essay, the title of which was—"The Description, Causes, Effects, and Cure of Epidemic and Contagious Diseases of Cattle, and the Means to prevent them and check their Progress."

In 1766 the subject for the prize was "The History of all Epizootic Diseases of Cattle, and of Animals of all other Species that are described in ancient and modern Authors, of the Causes that have engendered them, and of the Remedies that have been thought most efficacious in overcoming them."

In 1770, Antonio Zanon of Udine, one of the most celebrated of Italian economists, wrote an elaborate historical essay, which he read before the Agricultural Academy, wherein he forcibly contended for the importance of furnishing young men with the means of instruction as veterinary surgeons.

I need not dilate on the manner in which veterinary science has been encouraged by the agricultural societies of England and Scotland. Let their members, as its principally active patrons, learn what has been, what is, and must yet be done, that it may advance in due ratio with its importance, and let them contribute, as they can so largely, to enrich it with facts and observations.

That farmers can teach veterinary surgeons as well as veterinary surgeons farmers, and all to their reciprocal interest, is undoubted.

Who is it but the rearer of stock and the owners of animals in general throughout Great Britain that have studied Hygiene? Coleman impressed the public mind with the fact that proper

ventilation was essential to prevent disease; and the use of great quantities and good quality of food is constantly enjoined by veterinary surgeons. But opportunities for those extensive experiments, indispensable in Hygienic inquiries, as well as the primary incentive to their prosecution, which is private interest, can only occur to the wealthy landowner and agriculturists.

The fact that veterinary surgeons have not exercised great influence in bringing about great improvements in the breeds and management of the domestic animals, startles all with whom I discuss the point; but it must be readily acknowledged, if we consider the great advances made in the veterinary schools of the Continent, and particularly of France and Germany as compared with our own.

In a lecture on veterinary education that I delivered, as introductory to a course, in London, last winter, I said, speaking of the Continental schools: "Not only are the educational means accumulated in these institutions, monuments of foresight and indefatigable zeal on the part of their administrative and professional bodies, but the latter have distinguished themselves for the learned and preeminently useful treatises they have published on every department of our profession. Anatomy, experimental physiology, materia medica, therapeutics, botany, jurisprudence, general pathology, medicine, and surgery of our domestic animals, have been the object of invaluable works by the professors of Berlin, Vienna, Lyons, Paris, Toulouse, Stuttgart, Brunswick, Hanover, Brussels, and other cities. The unquestionable superiority of the state of veterinary knowledge in those countries compared with our own, contrasted with the no less certain superiority of our breeds of animals and their management in health, apparently constitutes a contradiction difficult of explanation. Not so, however. The large store of common sense, which seems to be one of the most privileged lots of Englishmen, their apparently innate affection for the perfection of animals, and a variety of other causes, had gained for us the superiority in breeding and rearing horses and cattle long before Bourgelat founded the school of Lyons. That supremacy we have ever maintained, irrespective of the rise and rate of progress of veterinary science; and it is peculiarly humbling to reflect that we, who by natural and acquired means have been enabled to enrich our land with greater wealth in animals than any other nation, should be last among the great powers of Europe in the possession of means for educating men in the best possible manner for averting the losses which this enormous capital is constantly exposed to by the ravages of disease." Girard said, "Connaître, élever, et conserver les animaux les plus utiles à l'économie domestique, tel est l'objet de la vétérinaire." With us it has ever been that the duty to appreciate and to rear domestic animals has not devolved on any class of professional men, but has been left to breeders and amateurs. Veterinarians do no more than attend their patients,

and it is a somewhat natural, but not very creditable, feeling that induces many to say, "We want disease."

To furnish that knowledge whereby the farmer and veterinarian may co-operate, is our intention, and the aim of the Highland Society. In accordance with that desire, one of my chief duties will be to travel over Scotland in the course of time, and study the geographical distribution of disease. We need that information respecting the maladies of special districts, which we possess to the smallest extent, and which it is so desirable to give to veterinarians and to agriculturists, that they may have some definite guide in the consideration of questions relating to sanitary improvements.

I am perfectly certain that much can be done by such a course of study, showing the relation of the occurrence of disease to some influences of transitory or permanent existence.

Sir John Stuart Forbes has urged the propriety of recognising the practical importance of meteorology in an agricultural point of view; and as agriculturists cultivate it, I trust we may reap the benefits of such study in relation to veterinary medicine, and happily tend to widen this field of research.

It must be obvious, then, from the foregoing reflections, that I wish to make my writings worthy contributions to science, and not scanty records, such as are presented to the general reader when medicine is treated in a popular style. Avoiding technicalities wherever it is possible and expedient, does not imply the evasion of scientific argument or fact. But as we must have fit designations for disease, Greek and Latin compounds will often be found side by side with the usual vernacular synonymes; and i studying the symptoms and nature of maladies, we shall not—indeed could not—forget their names.

I trust often to review works that are published on the Continent. It is not to criticise them so much as to extract useful information from their pages that I shall do this. It will be found that I quote extensively from authors not at all known in Great Britain; but in giving the titles of their treatises, those may be enabled to collect a valuable library who possess a knowledge of foreign languages. Some of the most celebrated writers on the diseases of animals are Gurlt, Hertwig, Dieterichs, Spinola and Gerlach of Berlin, Haubner of Dresden, Hering of Stuttgart, Fuchs of Carlsruhe, Röll and Müller of Vienna, Kreutzer, late of Munich and now of Wahnsinn, Wirth and Zangger of Zurich, Rychner and Anker of Berne, Jessen of Dorpat, Lessona and Ercolani of Turin, Leblanc, Delafond, Renault, Bouley, Reynal, Colin, Rey, Lecoq, Chauveau, Prince, Gourdon and Lafosse in France. I might continue mentioning names, but with little profit to my reader, and must single out a few so constantly recurring that something of the nature of their respective merits should be known.

Hertwig is renowned for many memoirs on the diseases of ani-

mals, for a work on the diseases of the dog, a treatise of operative surgery, and one on veterinary medicines. Hering of Stuttgart is one of the most learned men that adorn science at the present day; and not much less may be said of Kreutzer. Both Hering and Kreutzer have written largely and well on most subjects connected with veterinary science, exhausting, or nearly so, every attainable source of information. Hering's *Pathology* has not yet been surpassed by any work published on the diseases of animals. Rychner of Berne is a copious and learned author, but often loses himself in speculation, or mars his writings by their too theoretical groundwork. I shall constantly refer to his *Bujatrik*, or Handbook on the Diseases of Cattle, which induces me incidentally to mention the monographs and didactic treatises of one Francesco Toggia, an Italian, whom it were unjust to forget at the present moment. He belongs to the first quarter of the present century, but his works will ever merit the consideration of men. Toggia has largely contributed to throw light on the nature and history of many disorders, especially of cattle, sheep, and pigs. Dieterichs, Spinola, Fuchs, and Haubner may be classed next in order for the number and kind of their contributions to veterinary literature.

If I allude to French veterinarians next, it is not that they are absolutely behind the Germans; in kind they are frequently on a level; but the latter in general claim precedence in erudition, and collectively outweigh the first with the immense library they have furnished. Delafond ranks amongst the most painstaking observers, and his writings are, for some reasons, the most remarkable and useful that have appeared in his country since 1800. Renault has written less, but is likewise original. The productions of Bouley and Reynal are invaluable, and the three assistant-professors, Colin, Chauveau, and Gourdon, valiantly, but almost in vain, fight for individual priority. Time is required to judge impartially of their relative merits.

I have now given a brief sketch of what I have to do, and spoken of how it can be done, with the result, perhaps, of imposing upon myself more than I can accomplish. But I anticipate great difficulties: I am conscious that I shall not please all; and with a firm resolve to do my best, I trust at least to merit, what I shall thankfully receive, *counsel* and *co-operation*.

The first subject that I purpose discussing is one that I shall dispose of rather summarily, as the important truths connected with it admit of terse exposition, whereas to enlarge on the theories and views of authors would be to fill a heavy volume. I allude to the

INOCULATION OF PLEURO-PNEUMONIA.

The name of Dr Willems, of Hasselt in Belgium, is now well known as that of the discoverer of the supposed preservative influence of inoculation in pleuro-pneumonia. One of his warmest

disciples, Dr Didot of Bruxelles, says, "An epizootic malady decimated the bovine tribe, and menaced one of the most precious sources of our agricultural wealth, when a happy practice put a stop to its ravages, repelled its blows, and restored hope to the discouraged farmer." Volumes, containing weighty statistics, shrewd interpretations of fact, and theories of great but mostly treacherous ingenuity, have been published by men whose name and authority have inspired very generally with faith. But the fallacies of medical statistics, unavoidable as they are, and the deceptive nature of medical facts, should ever make us cautious in criticism and in the expression of opinion. There is a glaring consistency in lack of such caution on the part of all the advocates of Dr Willems' views. Such is the judgment I pronounce on them, after careful study of all arguments *pro* and *con*.

The manner in which cattle are inoculated may be briefly referred to. The solidified lung of an affected animal is cut and squeezed to procure a juice that readily flows with some blood and extraneous matters. The juice is considered the fluid component of the specific product of this disease; the solid matter is also in part an element of the product. The juice is filtered and refiltered, and sometimes a quantity is kept for use without having been cleared by this process. It is difficult to preserve this matter, and, though kept in cold situations, Dieterichs says it is of no use after eight days. The lymph for inoculation may be procured by simply plunging the point of the scalpel, used in the operation, into the diseased lung-tissue. There is a precaution to be exercised with reference to the choice of a piece of lung, and this is, that the animal whence it is obtained should not be in the last stages of the disease.

The place chosen for the operation is generally the extremity of the tail. Some of the hair is cut off, and an appropriate needle-shaped instrument is dipped in the virus, and plunged about half an inch into the dock. Two or three punctures may be made. A cough is said generally to supervene, and in about a fortnight swelling occurs at the seat of inoculation, which sometimes leads to loss of a portion of the tail. Fever is associated with the manifestation of this enlargement.

The danger attending the improper performance of the operation, and in what such improper procedure consists, may be gleaned from the following interesting case.

On the 4th of last May I was requested to attend a cow, in a dairy near Edinburgh, which had been inoculated for pleuropneumonia about a fortnight before. The plan had been recommended this cowfeeder by a person in Edinburgh who has a large dairy, and whose cows have been inoculated for the last two years, as it is said, with the best results. This person had even kindly furnished my client with a bottle of the stuff to be used, that had

been procured by squeezing lungs; and though well corked, putrefaction had been going on, so that the matter had an intolerably offensive smell. The operation was performed by means of a common double-edged scalpel, and a wound had been made on either side of the tail, not far from the anus; into these wounds the matter had been inserted. The constitutional symptoms had been very slight until the serious lesions next to be described were fully developed. I found the cow lying, and not giving evidence of very great systemic disturbance, but constantly straining for the expulsion of excrement. This could not be effected, as the root of the tail, but especially the anus, on all sides, and the external genitals, were involved in a painful and indurated swelling. The skin at these parts was glistening, and stretched to its utmost, especially on the left side. I was not called until the cow lost her appetite. I made several incisions to relieve the tumefied parts, and these readily yielded to the knife, and felt of gristly consistence. Little more could be done; the wounds bled freely, but not for long, though warm fomentations were persisted in. Next day my patient was in a hopeless condition, and on the 6th of May I ordered her to be destroyed. I procured the diseased parts, which have been preserved in the College Museum. I found that the solidified products of inflammation had accumulated to an enormous extent, stretching internally, and pressing within the pelvic cavity. They were undergoing organic changes, and an opportunity was thus offered me for some interesting observations.

It is very clear that in the above case the mode of operating, the seat of the cuts, and the nature of the matter used, were all against prescribed rule. But the case is a singularly suggestive one. Putrefaction completely alters the nature of organic substances, destroys all primary properties, and it robs animal poisons of all their potency and specific characters. A virus such as that of small-pox may be preserved in a dry or moist condition; but if it undergo any serious modification by decomposition, it loses its characteristic attributes. If the lymph exuded in the lung tissue in pleuro-pneumonia be specific in its nature, shall we find that it maintains that property, notwithstanding a complete alteration wrought in it during weeks and months that it is putrefying? In the case above quoted, it was clear that an irritant of more than ordinary strength had induced inflammatory action and exudation: the latter, infiltrating as it did the tissues, led to an appearance much like that of the diseased lungs. This anatomical character has been adduced as proof of the specific nature of the lymph in pleuro-pneumonia. It is no more than I have witnessed when other exciting agents have been introduced beneath the skin.

As to any special microscopical characters, although I desist from entering minutely into this part of the subject, I may mention that the lymph found in the lungs is like all other inflammatory lymph.

But it is a strange and conclusive fact that Dr Willems' defenders should have sought for proof where none could ever be obtained, and which strikingly accuses them of bias. No animal poison is recognised by its anatomical or chemical constitution. The saliva of the rabid dog, the matter of glanders, the virus of malignant pustule, may be studied in their effects, but not under the microscope or in the laboratory.

The swelling occurring a fortnight after the inoculation, and the concomitant fever, are looked upon as indicating a special mode of working proper to animal poisons. Admitting, for the sake of argument, that it may operate like the deadly agents that induce so much mischief in dissection wounds, this is no proof that it is specific. There is no proof that it answers to the reproductive law of "like produces like"—a law which is invariably obeyed in all inoculable or contagious diseases. As for the fever, it is irritative, and a consequence of the local morbid action, not a constitutional state essential to the occurrence of the latter.

But lastly as to statistics. An extensive cowfeeder in Edinburgh has followed out with the greatest benefit, for two years, the practice of inoculation, only one or two animals dying of pleuro-pneumonia, notwithstanding many injurious influences around them in close and filthy byres. Another dairyman has not inoculated, but during the same two years has been equally fortunate. He has taken the precaution to bleed and purge as soon as any of his animals appeared unwell. Not satisfied with this, but beguiled to try inoculation, he unfortunately pays for it with the loss of a valuable cow. Admitting that this was his own fault, those who might wish to appropriate the first important fact should carefully weigh even the second; and to prove how many fallacies interfere with collecting conclusive numerical facts relating to disease, I must mention, that in the byre where inoculation has been practised, several cows have of late died of pleuro-pneumonia, and all of them had been inoculated, but in the other dairy an immunity from the disease still reigns. The bleeding and purging is not by this proved a wise measure, inasmuch as many other circumstances attend such results, and Professor Dick has cleared dairies from the disease by simply attending to hygienic measures. I know a cowkeeper near Hammersmith who, in little less than three years, lost cows to the value of £800, but having failed, he had his byres rebuilt, and since 1852 has been quite free from the lung disease. I shall take some early opportunity to develop my views on this topic.

That animals thrive after inoculation has been considered extraordinary. It is no more so than the rapid return to health, and a plethoric state, after many fevers that attack domestic animals; and it is a fact repeatedly to be observed, that with changes of climate or mode of living, animals, like men, only thrive after some acci-

dental attack of indisposition that seems in some way essential to acclimatisation or to acquiring peculiar habits of life.

ON THE DISEASES OF SHEEP.*

The Royal Agricultural Society of Lyons bestowed a prize in 1821 to M. de Gasparin for a monograph on the contagious diseases of sheep. Gasparin, though in his early days a student at the Veterinary School of Lyons, has never considered himself one of our profession, but, devoting himself to rural economy, rose a few years since to be Minister of Agriculture and Commerce.

Gasparin's treatise still maintains a just celebrity, and it has not been cast into the shade by what has since appeared in print respecting the disorders of sheep. Ribbe,† Youatt,‡ and Wagenfeld,§ have dealt with the histories of local and sporadic ‖ affections, and not alone with contagious maladies or plagues. It has been the object of M. Seer to collect information from widespread sources, and bring to bear great practical experience in compiling a 12mo on the diseases peculiar to flocks of sheep.

Seer's little monograph is of especial interest to us, as it treats of some disorders that have not been spoken of elsewhere. It is a useful rather than a learned work. Seer speaks as a practitioner, and says that the innumerable opinions and explanations emitted by veterinary surgeons on certain diseases of sheep, have been productive of ill to the profession, and that he has found in practice that certain maladies assumed very different forms from those described by authors, and that these pass over in silence other affections that have occurred in his practice.

The eruptive affections described by Seer are the smallpox, a variety of chickenpox, erysipelas, three forms of herpes or tetter, the true scab, and, lastly, the benignant epizootic aphtha. I omit any reflections on the smallpox.

The chickenpox, that has nothing in common with the smallpox, is technically termed "varicella ovina sicca." It is an eruption that breaks out through a whole flock during long-continued periods of cold and damp weather, and from its extension often gives rise to much groundless fear. The shepherd at first perceives one of the animals covered with nodules about the size of millet-seeds; in some parts bladders are formed, or matter exists. An attentive examination of the flock reveals that most of the sheep are similarly affected. The disorder is not contagious, and disappears in from a fortnight to three weeks.

* Die Heerdenkrankheiten des Shaafe. The Diseases of Flocks of Sheep. By H. SEER. Glogau, 1854.

† Ribbe, Die Krankheiten des Schafviehs und deren Heilung. Leipzig, 1821.

‡ Youatt on the Sheep, 1837.

§ Wagenfeld Ueber die Erkenntniss u. Cur der Krankheiten der Schafe. Danzig, 1850.

‖ Attacking individuals, and not generally affecting large numbers at a time.

Haxthausen describes the chickenpox of sheep as accompanied by symptoms of catarrh. Sometimes inflammation of the absorbent glands supervenes, or swellings of the extremities occur, associated with ulcers. The catarrh is sometimes much aggravated; the head swells, and the disease may assume a fatal type, and spread by contagion.*

Hofrichter † has spoken of the same malady as the *tubercular pox*. As many as 30 per cent of the sheep died from the natural spreading of the disorder by contagion, but the mortality was reduced to 4 per cent by inoculation.

Eiselt ‡ has seen the nodules filled with matter like the white of egg, and of a yellowish colour; in from three to five days the bladders dried. Hering § witnessed a similar form of the affection in a flock at Zell in Würtemberg in the year 1831.

It is very obvious that several forms of pox affect sheep, and they have different grades of malignity. Erdt believes they are accidental deviations from the regular course of eruption of true smallpox. I have spoken of them at length, as the subject admits of development at the hands of those who have extensive opportunities of observing the diseases of sheep.

In referring next to erysipelas—the Saint Anthony's fire of man—which is inflammation of the skin with fever, it is important to distinguish two forms. The first is that briefly spoken of by Seer as occurring frequently after shearing, during fine weather, or as the simple effect of exposure to the sun. The skin of the back and flanks becomes inflamed, painful, and is apt to blister. When it occurs as the simple effects of the sun, Seer says there are signs of constitutional predisposition in the animals, and the pregnant ewes are apt to remain unaffected, whereas the converse obtains with the rams and wethers. This is quite a benignant variety of the disease, that scarcely requires treatment, or at most a little sulphate of soda dissolved in the water the animals drink. But the malignant erysipelas, that is known as occurring amongst swine as well as sheep, has been quite separated from the above by Seer. It occurs in plethoric animals in the autumn, during strong rains that have followed very sultry weather. The head is involved in the disease with the neck and back: it is much more dangerous than the form of erysipelas above described, but is in sheep a very mild affection as compared with swine. Youatt speaks of erysipelas under the heads of "*erysipelatous scab*," "*wild fire*," and "*ignis sacer*." At page 79 of his work, Seer speaks of the gangrenous or malignant erysipelas as a species of typhus, but which he has only seen in the pig; and what is known of it, he says, has been handed down to us by tradition. Lucretius, a

* Rust's Magazine, vol. 29. † Henke' Zeitschrift, 1831.
‡ Oestr. Jahrb., 32 vol.
§ Hering Specielle Path: u. Ther: fur Thierärzte, 1849.

Roman poet, has mentioned it as a very dangerous disease of sheep. Paulet, who had himself to treat the Saint Anthony's fire, says that Lucretius has faithfully portrayed the malady after Virgil and Columella. Hall has spoken of it as occurring in Great Britain.

Almost all cutaneous disorders in animals are looked upon as mange or scab. There are true scabby eruptions that are technically styled herpetic, and that are very frequent in animals, but rarely amongst us, distinguished from the malady that is associated with the development of a parasite or acarus. Seer defines three varieties. The first was long known to shepherds and the owners of flocks, but had not attracted the attention of veterinary writers till Dr Haubner, Professor at the Veterinary College of Dresden, contributed some observations upon it to periodical literature. The German name of it admits of literal translation as the "scurfy tetter," and technically it is called *Herpes crustosus*. It occurs amongst higher-bred sheep, especially in winter. On any part of the body, but especially over the back, the wool is seen to mat together and form a little bunch or knot, which is soon followed by general matting of the wool, a condition which gives to the sheep a peculiarly rough and ragged appearance. The wool is found glued to the skin by a greasy exudation: this material dries, and forms yellowish shiny scales, that, being inextricably fixed in the matted wool, has led to the name applied to the disease of "scurf in the wool;" the old wool, thus deteriorated, drops off, and the new forms on a clean skin. The eruption generally continues for about fourteen days, rarely longer.

The second form of tetter affects the extremities, and is apt to denude the head of hair. It is known in medical language as the *Herpes decalvans*, and occurs exclusively in the winter, and amongst the higher-bred sheep. Generally about the end of November or beginning of December, some animals are observed to rub one or other of their extremities. The wool loses its clear glossy aspect, and drops off in circumscribed patches about the size of a florin or half-crown piece. The denuded portion of skin is red and dry in the centre, but moist at the circumference, where there is to be observed an exudation in small drops. The itching increases, and by constant rubbing the skin becomes more and more inflamed; the wool continues to drop, and by the end of the winter the whole of the affected limb is bare. Greyish scales form on the skin until shortly after the new coat appears, and in the early months of the year the sheep resume their normal appearance.

This affection is one not likely to be seen much amongst us here, inasmuch as it is observed in Germany where the sheep are subjected to close confinement, being housed for months together, as the pastures are deeply buried in snow, and the cold is intense.

The third variety of herpetic eruption affects the lips and in-

vades the nose. It is called "Maulgrind" by the Germans, or "scab of the mouth"; its Latin designation is *Crusta labialis*. It is a kind of moist tetter or impetigo, and is excessively prevalent amongst lambs, but does not spare even aged animals. It is a sign of a constitutional state, and, according to Seer, is brought on by certain kinds of food, amongst which may be classed potatoes affected with the disease. In 1851 he observed a number of sheep on a farm, some of which had been fed on diseased potatoes, and others not; the first were all affected with sore scabby lips, whereas all that had only partaken of sound food were in perfect health. The disease presents itself by small inflammatory nodules occurring in rings round the mouth and nostrils. Little bladders filled with opaque matter (lymph) become developed, and then dry up into yellow or brown or blackish scabs. These drop off in from a fortnight to three weeks, without leaving scar behind them; sometimes, however, matter continues to form, and, according to Hering and others, by the animals being prevented sucking or properly feeding, they become much emaciated. It must be remembered that it is due to deteriorated food, but it may assume a contagious form; and Hering has seen a kind of tetter affecting the hands and face of men that had handled and treated sheep affected with this disorder. The use of astringents locally, but especially change of diet, suffices to stay the spreading and progress of the malady.

As my object here is to refer to those disorders that are almost, if not absolutely, passed over in silence by British authors, I shall not engage the attention of my readers with remarks on the true scab of sheep, or on the vesicular epizootic, that is known as principally affecting cattle, and respecting which much has been written. I shall speak of them when I have new facts to contribute to their history, or as illustrating their true nature.

The subject that we shall next consider, as referred to by M. Seer, is

SCROFULA IN SHEEP.

My readers must understand that scrofulosis is that condition of the system in which true *consumption* or *phthisis* develops itself; and, under these circumstances, a specific product, named *tubercle*, is deposited in the lungs, glands, and other organs of the body. This state of the constitution favours the occurrence of low and obstinate forms of inflammation, that are generally associated with but little heat or pain, but the general tendency of which is to destroy without offering scope for healing and repair. "In the living animal," says Seer, "the appearances of scrofula consist in general debility and want of blood; the creatures become emaciated, notwithstanding that their appetite continues, and digestion appears undisturbed. Their bellies enlarge, and they die sooner or later, without convulsions, in

a completely exhausted state. After death, but little fluid (serum) is found in the cavities of the chest and abdomen; the whole mass of blood is watery, contains little colouring-matter, and coagulates slowly and incompletely. The muscles are flabby, and the heart likewise. The liver is pale, and the gall-bladder distended with thin, watery, and pale-green bile. The stomach and intestines are filled with softened food, and there is often a considerable quantity of fat in the *caul* (omentum); the kidneys also have a normal covering of fat; so that no sufficient cause of death appears discoverable. On closer examination, the absorbent glands of the mesentery* are observed to be enormously enlarged; in six-months'-old lambs, the smallest are even larger than a hazel-nut—the largest, that are situated along the larger intestine, acquire the length and thickness of a man's thumb. The external aspect of these glands is darker than usual; and when cut across, they are found of a reddish or darkish grey colour, tending to black;" and Seer has also found them containing matter. Belonging to the class of scrofulous diseases in sheep Seer considers rickets, and a specific inflammation of the eyes. I refer the consideration of these to the next Number of the *Transactions.*

PROCEEDINGS IN THE LABORATORY.

By THOMAS ANDERSON, M.D., Regius Professor of Chemistry in the University of Glasgow, and Chemist to the Society.

ON THE RELATION BETWEEN CLIMATE AND THE VALUE OF CROPS.

No fact is more universally admitted than that all crops are liable to variations in quality when grown in different climates; but when we come to inquire into the grounds on which this opinion is founded, it is obvious that exact data for the determination both of the nature and the extent of these differences are exceedingly deficient. The question is, in reality, much more complex than it at first sight appears, and at the very outset we are met by the difficulty of defining the term "quality," which, when applied to agricultural crops, is employed in a sense somewhat different from its common acceptation. If we wished to compare two specimens of commercial silver, their relative qualities would of course be determined by the proportion of alloy which they contained; and the common opinion is, that the quality of an agricultural crop is estimated in a similar manner, so that when a particular sample of wheat, for example, is said to

* The mesentery is the broad membrane that connects the intestine with the spine. It generally contains much fat, and forms part of the *caul.*

be superior to another, it is thereby meant that it contains a larger quantity of nutritious matters, and a smaller quantity of those inert constituents which correspond to the alloy of the silver. This is undoubtedly the natural and simplest view of the matter, but in actual practice the system is entirely different: the nutritive value of the wheat is quite a secondary consideration, and its quality is estimated mainly by the quantity of fine flour which it is capable of yielding at the mill; and hence a wheat with a low nutritive value may, and frequently does, possess a higher market-price than that which the chemist, judging from its composition, might consider its due. The same is the case with barley; the characters which recommend it to the maltster being quite distinct from those which ought to be considered, if it is to be employed as food; for in the former case, abundance of starch, which is the spirit-producing constituent, is the main point, and as that is generally combined with a low proportion of protein compounds, which are usually considered to be the most important nutritive constituents of a grain, it follows that the maltster will select, as best adapted to his purpose, the sample of barley which ought to stand lowest as food. In short, the quality of a grain is not determined by its nutritive value alone, but by the use to which it is applied, or even by the prejudices of the consumer, who is content to judge of the quality of his bread, not by the real test of nutritive power, but by its external appearance. As a necessary consequence of these facts, chemists who have rested their opinion of quality upon nutritive value, have not unfrequently been at variance with commercial men, who naturally, and as far as their business is concerned, correctly maintain that the grain which gives the highest money-return has the highest quality. But when viewed as a strictly scientific question, where exact comparisons are to be made, it is obvious that the value determined by the quantity of real nutritive matters affords the only accurate and indisputable standard which can be employed, and that no account can be taken of those fancy values dependent upon prejudices which are not even constant, but vary with the habits and customs of different countries, and a hundred other circumstances.

Corresponding difficulties are occasioned by an imperfect knowledge of meteorological phenomena. It is known, in a general way, that certain districts are cold or wet, and the reverse; but when we come to seek for more precise information, it is but rarely that it can be obtained. The best thermometric and barometric observations may exist, but it is comparatively seldom that the rain-gauge or hygrometer are observed, although their indications are of paramount importance in relation to agriculture. An accurate estimate of a climate, in an agricultural point of view, really requires an amount of meteorological information which at

the present moment can scarcely be said to exist. It is not enough that the mean temperature of the year and annual rainfall should be determined, but the distribution of temperature and rain during the different seasons must also be ascertained; and this is requisite, because the range of temperature, and period at which rain falls abundantly, must necessarily have an important influence upon vegetation. There may, for instance, be two localities possessing the same annual mean temperature, but if the one has a low winter and high summer temperature, and the other a warmer winter and colder summer, the probability is that the former will, on the average of several years, produce better crops. In the same way, there may be two districts in which the rainfall is the same, but if in the one the greater proportion of it falls during the winter and early spring months, while the summer and autumn are dry, the crops will surpass those of the other locality, in which the rainy season is generally the summer or autumn. It would be easy to multiply such illustrations, and to show that much must also depend on what we are often inclined to consider as meteorological phenomena of minor importance, but those we have given will suffice to show the utility of such observations, and the necessity for a more extended cultivation of agricultural meteorology, before we can hope to obtain a satisfactory solution of the mutual relations of the quality of a crop, and the climate in which it is grown. It is sufficiently obvious that this cannot be accomplished by isolated observations, but must be the result of years of accumulated researches, in which agriculture, meteorology, and chemistry must go hand in hand, according to some definite plan. It is, perhaps, scarcely to be expected that, in the present state of matters, much should be done in this direction, the more especially as the requisite appliances can scarcely be said to exist; but every fact bearing upon the subject is worthy of notice, even though the observations are not as complete and precise as might be desired.

For this reason I think it right to place on record a series of analyses of turnips grown in Warwickshire and Argyllshire, which have been recently made in the Laboratory for Mr Malcolm of Poltalloch, for the express purpose of determining the difference in quality of the crop produced in these counties. They illustrate one of the great difficulties with which we have to contend in such inquiries, for we know nothing precise regarding the climate of these counties, further than that Argyllshire is characterised by the abundance of rain during the summer and autumn months, and by a low summer temperature, while Warwickshire has as favourable climate as any English county. The turnips analysed were swedes and yellows, both grown from the same seed in each locality, and treated in a precisely similar manner. The analyses were made by determining the water, nitrogen, and ash, and

likewise the quantity of phosphates contained in the latter. The results were as follows :—

Swedes.

	Warwick.	Argyll.
Water,	9339	9522
Ash,	50	50
Protein compounds,	75	44
Other constituents,	536	384
	100.00	100.00
Nitrogen,	12	7
Phosphates contained in the ash,	9	6

Yellow.

Water,	9411	9535
Ash,	70	72
Protein compounds,	62	50
Other constituents,	457	343
	100.00	100.00
Nitrogen,	10	8
Phosphates contained in the ash,	9	5

I have likewise determined the specific gravity and per-centage of dry matter contained in the juice of these varieties of turnip, using in each case two different turnips, in each of which the specific gravity was separately determined; but as the results in all cases approached very closely, the quantity of solid matter was only determined once, the juices of each pair being mixed for this purpose.

	Specific gravity of juice.	Per-centage of dry matter in juice.
SWEDE. — Warwick, No. 1,	1.0368	7.27
„ „ No. 2,	1.0377	
„ Argyll, No. 1,	1.0234	4.60
„ „ No. 2,	1.0254	
YELLOW.—Warwick, No. 1,	1.0318	5.98
„ „ No. 2,	1.0360	
„ Argyll, No. 1,	1.0260	4.96
„ „ No. 2,	1.0254	

Comparing these analyses, it is at once seen that the turnips grown in Warwickshire materially exceed in value those from Argyllshire. Restricting ourselves in the mean time to the swedes, it appears that those from the latter county contain nearly 2 per cent more water than the former. The importance of this difference becomes, however, more apparent when we take the quantity of solid matters into consideration. Ten thousand parts of the Warwickshire swedes contain 661 parts of solid matters, while the same quantity of those from Argyll contains only 440. If we assume the amount of solid matters as the measure of the nutritive value of the two samples, then it would follow that 2 tons of the

Warwickshire swedes must be equal to nearly 3 tons of the Argyllshire; and it is probable that this is not far from the truth, because we find that the quantities of protein compounds in the two cases bear a very similar relation to one another. Strictly speaking, the protein compounds would indicate a somewhat lower value, for while the ratio of the total solids is as 12 : 8.5, that of the protein compounds is as 12 : 7. The difference between the yellow turnips is similar, though not so great; the Warwickshire turnips give 589 of solid matters in 10,000, and the Argyllshire 465, being nearly in the ratio of 5 : 4, and the protein compounds are likewise present in this proportion. Hence it follows that 4 tons of the Warwickshire yellow turnips are equal to about 5 of the Argyllshire.

It is interesting to observe how closely the quantities of solid matters in the juice and the specific gravity tally with these estimates, for the numbers derived from the former are almost completely in accordance with the ratios deduced from the general analyses, and the specific gravity of the juice gives also a very close approximation to the relative values, if the first two figures be cut off in each case. Thus we have, taking the mean of the two determinations—

SWEDES.	Warwick,	1.0372	372
	Argyll,	1.0244	244

the latter numbers being almost exactly in the ratio of 3 : 2.

With the yellow turnip we obtain—

YELLOW TURNIP.	Warwick,	1.0339	339
	Argyll,	1.0257	257

and though the numbers 339 and 257 do not approach so closely to the relative feeding value, the difference is not very material.

In estimating the degree of reliance to be placed upon the conclusions to which these analyses lead, it is important to bear in mind that they are no more than isolated facts; and though I have already so frequently insisted on the caution which is to be exercised in such cases, I think it necessary to refer to it again distinctly, lest it should be supposed that I lay greater weight on them than they are entitled to. They are valuable only as showing that differences do exist, and of the kind we should be led *a priori* to anticipate; but I am not inclined to believe that we are entitled to conclude that the differences in value will always or even frequently be so great as those observed in the present instance. It is very doubtful whether these can be considered as crops of average quality in either district—at least the turnips are materially inferior to the average deduced from the very numerous analyses already published in the Transactions of the Highland

Society,* and hence I do not think it right to draw more than a very general conclusion from them.

There is another question regarding these turnips, on which, unfortunately, I am unable to throw light. It is, whether the total amount of nutritive matter produced by an acre of land in Warwickshire exceeds that in Argyllshire—in fact, whether the weight in the latter county may not so far exceed that in the former that the difference in value may be in part, or even entirely, counterbalanced. But as I have no information regarding the weight of the crops, this point must remain undecided. It is well known, however, that the most bulky crops are generally obtained in wet localities, so that in all probability the Argyllshire crop excelled that in Warwickshire.

Limited as the facts are which I have hitherto been able to obtain on this subject, they are, I believe, sufficient to awaken attention to points on which we are extremely imperfectly informed, and on which precise information is much required. Now that there is every prospect of agricultural meteorology receiving its due share of attention, it will soon be possible to proceed further in its investigation, and to arrive at more satisfactory conclusions than the imperfect state of our knowledge on that subject at present permits.

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* *Transactions of the Highland and Agricultural Society*, January 1852.

RETURNS OF SEED COMPETITIONS held in 1855 and 1856.

Districts.	Seed exhibited in competition. Names of Species and Varieties.	Quantity. Qrs.	Number of Competitors.	Award. L. s. d.	Competitors to whom Silver Medals were adjudged. Christian and Surnames.	Estate or Farm, and Post-Town.	Produce per Imperial Acre.	Weight per Bushel. Lb.	Date of Sowing.	Date of Reaping.	Ground on which the Prize Seed was grown. Altitude. Feet.	Exposure.	Nature of Soil.
Renfrewshire.	White Wheat (Farmers' Friend), ...	3	4	3 0 0	Andrew Robertson,	Hillington, Paisley, ...	11 bolls.	66	Nov. 14, 1854	Sept. 25, 1855	50	S. E.	Loamy soil.
	Sandy Oats, ...	3	3	3 0 0	Matthew Gilmour, .	Town of Inchinnan, ..	6 qrs.	44½	April 1, 1855	Sept. 1, —	6	S.	Sandy loam.
	Potatoes (Walker's Regents), ...	half ton.	7	3 0 0	Alex. Cunningham,	of Craigends, Houston,	13 tons.	..	Planted. April 24, —	Dug. Oct. 24, —	35	S. E.	Free soil.
Kintyre.	Sandy Oats, ...	3	2	2 0 0	Alex. Snodgrass, ...	East Chescan, ...	7 qrs.	44	April 2, —	August 28, 1855	40	S. E.	Clay loam.
	Bere, ...	3	3	2 0 0	James Letham, ...	Tradigle, ...	8 qrs.	54¾	April 28, —	August 12, —	20	W.	Clay loam.
	Perennial Rye-grass Seed,	2	3	2 0 0	Mathew Andrew, ..	Andrewstone, ...	4 qrs.	25½	April 14, —	July 11, —	50	W.	Light loam.
Buchan.	Early Berlie Oats, ...	3	13	2 2 6	William Scott, ...	Wester Rora, Longside,	6½ qrs.	43½	April 7, —	Sept. 12, 1855	80	S.	Clay.
	Perennial Rye-grass Seed,	2	4	2 0 0	George Anderson, .	Hallmoss, Peterhead, ..	22 bush.	25¾	———	July 28, —	15	S.	Blue clay.
Wester Ross.	White Essex Wheat, ...	3	3	2 0 0	John Binning, ...	Brae, Dingwall, ...	4 qrs.	65¾	Nov. 1, 1854	Aug. 24, 1855	120	S.	Clay.
	Chevalier Barley, ...	3	3	2 0 0	John Polson, ...	Moy, Strathpeffer, ...	5 qrs.	57¾	April 20, 1855	Aug. 18, —	250	S.	Clay loam.
	Sandy Oats, ...	3	5	2 0 0	Allan Cameron, ...	Dreim, Beauly, ...	5 qrs.	43¼	March 28, —	Sept. 4, —	200	S.	Light loam.
	Perennial Rye-grass Seed,	2	2	2 0 0	John Mackenzie, ..	Kinettas, Strathpeffer,	3 qrs.	27¼	April 5, 1854	July 10, —	300	S.	Black loam.
Banff.	Sandy Oats, ...	3	7	2 0 0	Alexander Murray,	Old Manse of Boyndie,	8 qrs.	45	April 7, 1855	Aug. 30, 1855	70	E.	Sandy, on rocky bottom.
	Chevalier Barley, ...	3	2	2 0 0	William Webster, ..	Kirkside, Banff, ...	5½ qrs.	59	April 9, —	Sept. 4, —	20	N.	Sandy, on small stony bottom.
	Lord Western's Barley, ..	3	6	2 0 0	Andrew Longmore,	Rettie, Banff, ...	8 qrs.	57½	May 1, —	Sept. 14, —	60	S.	Light black gravelly soil.
	Perennial Rye-grass Seed,	2	7	2 0 0	Alex. Morrison, Jr.,	Turriff, ...	4 qrs.	30	April 7, 1853	July —	—	S. E.	Dry, sandy.

ON THE CHEMICAL PRINCIPLES INVOLVED IN THE RECLAMATION OF WASTE LAND.

An Address, by Dr ANDERSON, *delivered at the Monthly Meeting, 3d December* 1856.

IN a country like our own, where a large and rapidly increasing population consumes an amount of agricultural produce greatly exceeding that obtained from the whole breadth of soil under cultivation, it seems surprising that any land capable of being brought under tillage should be allowed to remain unworked. Statistical tables, however, assure us that the land still waste, though capable of cultivation, amounts, in England and Wales, to 3,984,000 acres; in Scotland to 5,950,000; and in Ireland to 4,900,000 acres. The data upon which this estimate is formed are probably not very precise, and it may possibly exceed the truth, or include considerable quantities of land so inferior in quality that their reclamation could not be attempted with any very great prospect of success. But after making due allowance for this, it is certain that the breadth of land which might be cultivated, but still remains unproductive, is very large, and affords an extensive field for enterprise and skill. No one will be found to dispute the position that the reclamation of such land is highly important, and, in some points of view, perhaps even the most important, of all agricultural operations. To increase the produce of cultivated land may, in many instances, be more profitable both for the landlord and the tenant, but to bring new land under cultivation greatly exceeds it in national importance. In the former case an addition is made to the quantity of food available for the existing population, but to cultivate a district previously waste is to establish a new population supporting itself by its own produce, and sending its surplus into the market, there to be exchanged for manufactured goods and imported commodities; thus, to a certain extent, fulfilling at our own doors some of the objects we seek to attain by the establishment of distant colonies, and not only increasing the quantity of food, but stimulating the general prosperity of the country.

However important this consideration may be to the political economist, it is not to be expected that the proprietor of waste land should be much influenced by the national advantages of reclaiming it. He will naturally look upon the question in a personal light, considering only the way in which it may affect himself, and how far he may expect to obtain a fair return for the necessary outlay, both in the rent accruing from the reclaimed

land, and the collateral benefits derived by the adjoining lands already under cultivation. It is not my intention to enter here upon the question of the reclamation of waste land in its economic aspect, but it is impossible to touch upon a subject of which the cost is an essential element, without remarking that, in all the improvements of waste land recorded in the Transactions of the Society, the results have always been highly encouraging. In a considerable number of cases the improvements have been made at the sole expense of tenant-farmers; and though the published reports generally embrace only the results of the first five or six years, the large proportion of the original outlay reimbursed within that period sufficiently indicates that the profit over a series of years must be very considerable. In fact, the inference to be drawn from them is, that there are very few investments for capital so profitable; for it appears very clear that, under circumstances not remarkably favourable, a return of something like 10 per cent on the outlay may be fairly reckoned on. It may be urged, indeed, that the published reports must be taken with some reservation, both because only the most favourably situated tracts of waste land have as yet been reclaimed, and of these, only selected and peculiarly successful cases have been made public. But admitting even that the return does not exceed 5 per cent, and making allowance for the benefits derived by the adjacent land, which will be afterwards more particularly adverted to, such improvements must be considered as decidedly remunerating. It has even been contended that if a landlord gets no more than 3 or 3½ per cent return—that is, as much as can be usually obtained for money invested in land—he ought to rest satisfied with the result. But this appears to me to be an extreme view of the matter, because in that case it would be more prudent, and in all respects preferable, for him to invest his money in the purchase of cultivated land, from which he is sure to obtain this return, rather than in improvements which must to some extent partake of a speculative character.

But without enlarging further on these points, which are foreign to the special object of this Address, I proceed to observe that, in attempting to reclaim waste land, one great element of success must of necessity be the determination, with as great accuracy as circumstances permit, of the cause of its previous infertility. And here the improver will direct his attention to the natural disadvantages of the locality in climate, height above the sea, accessibility, &c., and endeavour to ascertain which of these can be overcome, and which are inseparable from its position. Supposing these to be reasonably favourable, it must be concluded that the infertility of the soil is due to defects either in its mechanical or chemical constitution, or both of them. The latter is by far the most usual case, for it is comparatively rarely that infertility can be traced to one single cause,

but is generally due to the simultaneous action of several, and it can very rarely be traced to purely mechanical defects in the structure of the soil. Occasionally, indeed, a soil may be sufficiently fertile, but its cultivation be prevented by large stones, or boulders, which form an impediment to the plough, and in such cases the remedy is obvious. But the mere removal of stones and boulders seldom leaves a fertile soil, for the water which deposited them in its passage over the surface, has generally possessed sufficient force to carry along with it the finer and more fertilising particles of the soil, and its real improvement must be effected by other operations. It is scarcely necessary to observe that the removal, not merely of boulders and earth-fast stones, but of the smaller stones which are often found on moorish land in immense abundance, is, generally speaking, a very important part of the mechanical improvement of a soil. But it is worthy of remark, that this may be pushed too far, and has in some instances been followed by disadvantageous consequences. This has been chiefly observed in reclaiming thin moorish soils resting upon rock or rocky subsoils, which, when turned up by the plough, have been found to contain a quantity of stones so large that they have been removed literally by hundreds of cartloads. In these cases the chief mechanical defect of the soil is its thinness, rendering it peculiarly liable to frost during winter, and in summer to be parched by a drought which would not affect a deeper soil. This defect is aggravated by the removal of a large quantity of stones, which, though they add nothing to the fertility of the soil, serve to increase its bulk, and consequently its depth, and to protect the roots which penetrate under and among them from the vicissitudes of the weather. Hence in such soils the stones should not be removed at once, unless their place can be supplied by an addition to the soil, but only taken out at intervals, as cultivation advances and its quality is improved.

When mechanical and chemical defects are conjoined, the former are usually of a kind very dissimilar to those now referred to, affecting chiefly the minute texture of the soil, and so intimately connected with its chemical constitution that they cannot well be considered separately, and, moreover, are generally removable by similar treatment. In discussing these points, it is necessary to recall to mind that the constituents of soils, like those of plants, may be divided into two great classes, the organic and the inorganic; and the latter may be subdivided into those capable of being absorbed by the plants, to supply their inorganic food, and those serving merely to give bulk to the soil, to afford support to the roots, and to retain to a certain extent those more important and essential constituents of plants which are liable to a constant waste. Of these three subdivisions the last greatly preponderates, and constitutes at least four-fifths of the entire weight of the soil, and

sometimes considerably exceeds this quantity. Next in point of abundance are the organic constituents, while the inorganic or mineral plant-food is the smallest of all, and frequently does not exceed 5 per cent of the soil. A proper adjustment of the proportions of these great classes of constituents is one of the most essential conditions of fertility, and a derangement in the proper quantity of any one of them, no matter whether it be in excess or deficiency, is alike injurious. In fact, derangement of the relative proportions of the soil-constituents is the most frequent cause of infertility; and by ascertaining the means by which the true balance may be most quickly and economically restored, we fix also the most suitable means of reclaiming it. In every case a proper understanding of the defects of the soil is essential, and just in proportion as these have been correctly detected will be the success of the operations founded upon them; for the selection of the best and most convenient means of rectifying them must depend upon the nature of the defects. Hence it is that no one method of reclaiming land can be adopted in every case, but each class, even each variety of soil, requires its own particular method.

Peat.—Of all cases in which the balance is deranged, peat is the most familiar, as it is in some respects also the most singular. It is singular, because, being composed of the partially decayed remains of moss-plants, it contains in abundance all the elements required to maintain the existence of plants, and hence might be expected to be favourable rather than injurious, in so far as it affords a supply of these elements far larger than is ever added even by the heaviest manuring. To understand why land so rich in the elements of plants should be doomed to infertility, as well as how it is best reclaimed, let us direct attention for a moment to the mode in which a peat-moss has been produced. We are then carried back to a far-distant period, when what is now a sterile and dreary waste was a fertile flat, from which the waters freely drained away. Owing to some change in the configuration of its surface, due perhaps to a flood carrying down a quantity of earthy matters, and depositing them at the outlet, or to some similar cause, the water stagnates upon it. The congenial moisture develops a rapid growth of moss-plants, which spring up amidst the stagnant water, and still farther block the outlet. Generation after generation of these plants grow, die, and are replaced by others; and the ever-stagnant water, excluding the air, prevents their decay and destruction, and each successive crop rises above the last, until the mass accumulates to a depth limited only by the level at which the water can find a free escape. That this is the history of its progress, and that under it is hid a fertile soil capable of cultivation, and which did once support a population, is unquestionable. For beneath it lie the rude huts of a primitive race, and beside them is found the inhabitant himself, converted into a mummy by the antiseptic properties of the peat,

and still clad in his dress of skin, the canoe which he paddled across the water, the stone axe with which he hollowed it out of the trunk of a tree, whose massive roots are still imbedded in the subjacent soil; the stone arrow-head with which he hunted down his game, and the bones of the extinct elk which he pursued,—all indications that the soil now covered was once a fertile tract, selected as their fixed habitation by that primitive people, whose only record it has served to preserve.

The consideration of these facts at once suggests, as the most natural, or at least the most effectual mode of reclaiming a moss, the removal of the accumulated mass of sterile peat, and exposing the fertile soil it covers. But it is scarcely necessary to observe that this must, generally speaking, be an impracticable operation, and only possible in rare and altogether exceptional cases, such as that of Blair-Drummond moss; and the only method which can be employed in the majority of cases is, not to remove the peat, but to convert it into fertile soil: and here the mode of its formation materially assists us. We see, in fact, that the cause of its infertility is the undue accumulation of vegetable matter, occasioned by the retention of water, which prevents its decay. In an ordinary soil lying on a slope, the rain which falls upon it freely permeates its pores, and, as it escapes, permits the access of air in its place. And thus by the all-powerful action of the atmospheric oxygen, each generation of plants growing on it undergoes a more or less rapid decay, and the valuable substances which they absorbed during their growth are again set free, and prepared for the use of the next crop. But when the water stagnates in the soil, air, the great agent of all natural decompositions, is excluded, decay is arrested after it has proceeded only a very little way; and the remains of the plants, in place of being more or less completely transformed into carbonic acid and ammonia, are converted only into humic, ulmic, and other analogous acids; and then the decomposition stops, leaving these substances in forms which are incapable of acting as the food of plants, and moreover envelop and protect from absorption the useful mineral matters. And thus the valuable plant-foods are all locked up, with the exception of the small quantity liberated by partial surface decay, and sufficient only for the support of a scanty growth of those plants whose roots lie near the surface, and so obtain a sufficient supply of air; or of aquatic plants, whose structure specially adapts them for such localities. But the conditions of the soil which favour the growth of aquatic plants are the least advantageous to our cultivated crops, all naturally inhabitants of rather dry soils, and sending their roots down to a somewhat considerable depth; so that, when planted in peat, they penetrate to a layer where no decay and liberation of their food takes place, and which, moreover, is so saturated with moisture as to be foreign to their natural

habits, and injurious to them even if the necessary substances were present in a form capable of ready absorption.

To convert peat into a fertile soil, we must therefore adopt such means as shall admit air into its pores, and, thus promoting its decay, remove the excessive quantity of organic matter it contains: and this is really, in a manner, to remove the peat itself, substituting only for mechanical processes the more gradual, but not less effective, action of the atmospheric oxygen, and endeavouring, during the progress of the decomposition, to make use of the matters which are liberated in proportion as they are set free.

To attain this end, the moss must be made dry by efficient drainage; and it becomes necessary to ascertain how this can be most cheaply and efficiently effected. In determining this point, we derive some information from considering the mechanical properties of peat. Of these the most characteristic is its porosity, which is so great as to make it resemble a sponge, water permeating freely through it in all directions. Hence if one portion be made dry, it follows that the moisture contained in the other parts will gradually distribute itself through it, just as happens with a sponge, out of one end of which the water has been squeezed. The manifest conclusion to be drawn from this fact is, that if a portion of a peat soil be dried by drainage or otherwise, it will always be liable to the infiltration of moisture from the parts left in a wet state, and that the most effectual plan is to remove the stagnant water from the whole moss, and not to restrict operations to the part which is to be immediately reclaimed. A single deep ditch, dug down to the bottom of the peat, or as near it as possible, taking care to secure a good outfall, will remove a considerable quantity of the moisture, not merely from its immediate neighbourhood, but from the whole moss, and cause a consolidation highly favourable to the subsequent operation of thorough-draining. It is perhaps unnecessary to observe, that in many cases this preliminary drainage may be useless or impracticable; but where it can be effected, it presents very great advantages, both from the consolidation already alluded to, and because, if the bottom of the peat be left saturated with water, it is hopeless to expect complete dryness above; for the instant the upper portion loses the water it contains, it acts like a sponge, and sucks up a new quantity of moisture from below. Tile-draining, by affording an outlet for the superfluous water down to a certain depth, produces a very great improvement; but it must not be supposed that it is practicable, either by this means or by the preliminary drainage already mentioned, or by both together, to make a peat as dry as an ordinary arable soil; for this is incompatible with its physical properties. In fact, the extent to which a soil can be made dry is dependent, not merely on the drainage, but also to a very great extent upon its power of retaining water, in regard to which different

soils vary within very wide limits. In order to illustrate this point, let us suppose a very fine sieve to be filled with a dry soil, and water to be poured upon it. The water, of course, will trickle through the soil, and the greater part escape by the meshes of the sieve; but a certain quantity, dependent on the texture of the soil, will always be retained within its pores by capillary attraction. The former will represent that portion of water which flows off by the drains, while the latter will never enter them at all, and can only be got rid of by evaporation. Schubler, to whom we owe a very careful and elaborate series of experiments on this subject, has shown that an ordinary arable soil never retains in this way more than half its weight of water, and the lighter and more sandy soils much less; while pure humus—that is, decomposing vegetable matter—is capable of holding nearly four times that quantity, or about twice its own weight. But peat possesses this property to a still larger extent; for I have found a specimen of good quality, taken from the surface of a moss, able to retain six times its weight, or twelve times as much as an ordinary arable soil; and even after being squeezed between the hands as forcibly as possible, it still retained nearly three times its weight. Not to force matters too far, let us suppose that the specimen of peat used in this experiment was twice as porous as the average—although I have no reason to suppose that it was in any way exceptional—then it is obvious that, in order to render peat quite dry by evaporation, it must be exposed to the air for six times as long as a retentive arable soil, and consequently cannot become satisfactorily dry except during a long continuance of dry weather. But as peat possesses a great amount of capillary attraction, it is clear that if the portion underlying the drains remain filled with stagnant water, its moisture is liable at any time to be drawn up into the upper and drier portion,—just as a sponge, when one portion of it is allowed to touch the surface of water, soon becomes saturated throughout; and hence the advantages of removing the water as much as possible down to the bottom of the moss, so as to reduce it as nearly as may be to the quantity which may be retained by capillarity. It is impossible to estimate the extent to which this passage of moisture from the lower to the upper portion of a peat takes place. But setting it entirely aside, and resting the case merely on that retained by capillary attraction, it is manifest that, even with the most successful drainage, a peat is much less favourably situated than an arable soil for the decomposition of its vegetable matters; for its pores must be saturated with moisture during a much longer period of the year, and the access of air so necessary for this decay be proportionally diminished.

The preceding remarks show that drainage, though it is the fundamental step, cannot in itself secure all the conditions necessary for promoting the decay of peat, and liberation of its valuable

matters, in the quantities demanded by the crops which it is proposed to cultivate upon it; and hence it becomes necessary to accelerate the process by the addition of some substance capable of acting chemically upon it, and promoting decomposition. The number of such substances, which can be practically employed, is very restricted; indeed, with the exception of lime, there is no material of sufficiently low price to be employed in quantity. The methods of using it, and the rationale of its action, have been so often and so fully discussed, that it is unnecessary for me to advert to the subject here. I shall content myself with observing, that it appears to act upon peat, partly by combining with the humic and other allied acids, diminishing their antiseptic properties, and so depriving them of the power of preventing the decomposition of the other vegetable remains; partly by causing these substances to undergo a more rapid decay by disposing them to pass into the state of carbonic acid and ammonia, and partly also by adding to the proportion of mineral matter. Theory indicates that these objects will be best obtained by using the lime in its hot state, and mixing it as rapidly as possible with the peat, because it then exerts a much more powerful action than it does in the mild state, that is to say, when it has absorbed carbonic acid, by which its corrosive and decomposing action are greatly diminished.

Draining and liming a peat-moss are both directed to the same end, and aim at diminishing the quantity of organic matters,—the former by promoting the free admission of air, the latter by producing the conditions most favourable to the decomposing action of the atmosphere, and so restoring the balance between them and the mineral constituents of the soil. The success attending the operation must depend upon the possibility of causing the peaty matters to decay at a rate more rapid than that at which the mineral matters are removed by the crops growing upon it, and likewise upon the existence in it of a sufficient supply of the substances required by the plants. A very slight consideration of the composition of peat will suffice to show that its conversion into a soil at all resembling ordinary arable soils, must even, under the most favourable circumstances, be an extremely slow process; and if we bear in mind that the tendency of careful cultivation is to increase rather than diminish the quantity of organic matters, we shall see reason to doubt the possibility of ever removing any considerable proportion of those elements. In fact, when it is known that dry peat contains most commonly from 3 to 10 per cent of mineral matters, and rarely more than fifteen, the remainder consisting of vegetable substances, we cannot fail to see that its conversion, by the means already referred to, into a soil in which these proportions are reversed, is practically impossible. But it will be asked, is it necessary to do this? If, as is generally alleged, the sole use of the great mass of the mineral constituents of a soil is merely to give it

bulk, and retain the useful substances which form only a small proportion of its weight, why should not the peat itself, which is notoriously a good absorbent of ammonia, and forms a porous mass through which the roots can easily penetrate, fulfil this object? The possibility of obtaining good root and even grain crops from drained and limed moss, with a liberal supply of manure, will be at once conceded. But it is not the less certain, that the conditions under which this is done are forced and unnatural, and both physically and chemically disadvantageous. These disadvantages will be rendered conspicuous if we contrast more closely than we have yet done the properties of an arable and a peat soil.

A good arable soil has a specific gravity about two and a-half times as great as water, but being a highly porous substance, a given bulk in the dry state weighs only half as much again as the same bulk of water. Calculating on these data, it has been ascertained that the soil, on an acre of land 10 inches deep, must weigh in round numbers 1000 tons. This depth being that moved by the plough, may be considered to represent the whole quantity of soil from which the plants, under ordinary circumstances, derive their food, and it will contain in round numbers 900 tons of mineral matters, of which from 30 to 50 tons consist of substances absorbable by plants,* and the organic matters contain from 2 to 3 tons of nitrogen. Further, it will absorb, by capillary attraction, about 500 tons of water per acre. The specific gravity of peat is very variable, but that of a specimen I have examined was, when quite dry, nearly the same as that of water; but owing to its excessive porosity, a vessel packed full of it weighed only one-sixth of the same bulk of water, and consequently 10 inches depth of it on an acre must weigh only about 100 tons; and as it was found to contain no more than 4 per cent of ash, it follows that an acre, to the depth of 10 inches, contained only 4 tons of mineral matters. These being derived from decaying plants, consisted in great part of true plant food, although they contained a small proportion of clay and other inert compounds. We see, therefore, that peat is enormously deficient in mineral plant food, but it contains in its vegetable remains a quantity of carbon, amply sufficient to afford the requisite supply of carbonic acid, and about 1.5 per cent of nitrogen, equal to about a ton and a-half per acre, or little more than half the quantity contained in a good arable soil. The low specific gravity is also a serious defect, for even when fully saturated with moisture, of which it is capable of absorbing about five times its weight, the weight of an equal bulk is less than half that of an arable soil saturated with water; and when both are partially dry, the difference is still greater: and hence it must present a far less

* In this estimate I do not include the whole of the silica contained in the silicious matters present in the soil, but only the soluble portion, which alone is available as the food of plants.

efficient support to the roots. If now we are to rely upon the action of air and lime to correct these defects, it is clear that an enormous quantity of the organic matters of the peat must undergo decay. In fact, if the available mineral plant-food is to be raised only to the proportion found in good arable land, it would be necessary to cause the decay of about eight feet of peat, and to accumulate all its inorganic constituents in the subjacent ten inches, and this would produce a very trifling change in its physical characters, adding but little to its specific gravity, and leaving it nearly as porous as it was before. The natural decay, therefore, however much it may be encouraged by drainage or lime, can never effect these changes which must be produced by purely artificial processes, such as burning or mixing with clay, or some other mineral substance.

Both these processes have been extensively used. The former was at one time common in this country, though now, I believe, comparatively seldom resorted to, but immense tracts of peat soil have been reclaimed in this way in Finland: the latter has also been frequently employed. Both are founded on correct principles; but burning is an expensive process, and cannot generally be carried out to an extent sufficient to add materially to the proportion of the inorganic matters. It is easy to see that the lime added in reclaiming a peat-moss must operate as an addition to the inorganic matters as well as in promoting decomposition, for a dressing of 8 tons applied to such a peat as that I have already so frequently referred to, must at once triple the quantity of inorganic matters it contains. In exactly the same way, to deposit upon an acre of newly reclaimed peat 10, 20, or 30 tons of a mineral soil, is to produce a change in its composition and physical structure, of much greater magnitude than it might at first sight appear. It is true that in the latter case the substance added consists chiefly of the inert mineral matters, and contains a trifling proportion only of those absorbed by plants; but the effect produced upon the mechanical structure of the soil is as great, and I am inclined to attribute a very great effect to this, because, under any circumstances, manures, containing of course all the mineral constituents of plants, must be used, and that abundantly, in order to secure a crop.

As far as the manures to be employed on peat soil are concerned, it might be inferred that a preference is to be given to those which are purely inorganic, coupled with a quantity of ammonia, but without vegetable matters, of which it already contains an ample supply. But there are also very important advantages attending the use of farmyard manure, because it contains a quantity of organic matters in a state of active decay, and it is a well-known chemical fact, that in such cases the decomposing matter causes substances which otherwise show no tendency to decay to pass into a state of decomposition, and hence it promotes

that action in the peat which it is most important to secure. Portable manures of all kinds are also useful, and particularly guano, because a supply of ammonia larger than that which can be liberated by the peat decomposed during a single season is required to produce a luxuriant crop. In a word, liberal manuring is of the utmost importance; and the improver of peat land may rest assured that there is no part of his expenditure which will make so rapid a return. But I am inclined to put much reliance also on the improvement of the texture of the peat, by the admixture of abundance of mineral soil. Without it, no doubt, good crops may be obtained on some sorts of peat, although to do so a continual conflict must be maintained between nature and art, and renewed with undiminished vigour every year, but which may be speedily terminated in favour of art, when means are taken to make its mechanical properties approach as nearly as possible to those of naturally fertile soils.

Soils deficient in organic matters.—Over wide districts of our country are found extensive tracts of land, in all respects the opposite of peat, and characterised by a remarkable deficiency in organic matters. These soils are generally found to support a very scanty vegetation, growing in a thin layer of mould, beneath which lies an open sandy or clayey soil, sometimes containing scales of mica, and obviously produced by the disintegration of some of the earlier rocks. In such soils, deficiency of organic matter is not the cause but the consequence of infertility. All observed phenomena teach us that the want of organic matters is no absolute cause of barrenness, for they tend to show that the primeval soils were all equally devoid of these constituents, and formed entirely from the minute particles of rocks disintegrated by the simultaneous action of air and water, and carried by the latter agent to spots far distant from their original site. The soils thus deposited necessarily varied in their properties with the nature of the rocks from which they were produced. In one case a silicious rock yielded a marly pure sand; in another, trap produced a deposit containing its characteristic ingredients; in a third, a limestone gave rise to a calcareous soil; and in a fourth, the water performed a sort of rude analysis, depositing in one place the heavy grains of sand, and carrying to a greater distance the lighter and more fertilising particles of the rocks over which it swept. On these deposits plants sprung up, and where they found abundance of inorganic matters, gathered from the air an ample supply of the organic elements, reached a luxuriant growth, and dying, returned to the soil all that they had taken from it, along with the organic matters they had absorbed from the air, and which by undergoing decay, at once promoted the further disintegration of the mineral matters of the soil, and, affording within itself a source of the organic constituents, supplied the conditions of

a more abundant and gradually increasing vegetation in future years. If, on the other hand, the soil were deficient in the mineral food of plants, or contained it locked up in the form of compounds which are scarcely or not at all acted on by the air, a proportionately scanty vegetation was produced, which decayed again so rapidly as to prevent the accumulation of organic matters and the consequent amelioration of the soil.

The improvement of such soils must therefore be effected chiefly by the addition of mineral plant-food; not that organic matters are unimportant or ought not also to be used, but because the plants can always draw a certain quantity of the latter from the air, while they are of course solely dependent upon the soil for their supplies of the former. The mode in which this is to be most advantageously set about, depends, to a great extent, on the nature of the soil. If it be sandy and of open texture, it will be useless to attempt the addition of purely mineral manures, because, from deficiency of substances capable of absorbing and retaining them, they must inevitably be washed out of it again with great rapidity, and long before the roots of the plants have been able to take possession of them. And here, just as with peat, the alteration of the texture of the soil becomes an important element in the improvement. For this, the main requisite is to obtain such substances as make it more retentive, that is, prevent the rapid waste of manure. Now, it has been shown that in an ordinary soil the clay and organic matters possess this property in a high degree, and where they can be obtained their addition will fulfil the required object. It is rarely that a clay of some sort is not available, and any one may be added with advantage in considerable quantity; but, of course, there is great room for the exercise of judgment in its selection and treatment. In almost all instances, I believe, it would be advantageous to form a sort of compost of clay and lime, so as to promote the decomposition of the former before it is applied. For this purpose, the two may be mixed in the proportion of one part of hot-lime to two or three of clay, left in a heap for some time, and then spread along with an additional quantity of clay. When clay cannot be obtained, peat may be advantageously employed, and the most judicious way of doing so would probably be to compost one quantity with half its weight of lime, so as produce an effectual decomposition of its inert vegetable matter, and to interstratify another portion with farmyard manure, and then apply both, the former when the land is ploughed, the latter at the time of sowing. When clay and peat can both be obtained, the most perfect plan would doubtless be to make use of both, so as to make it as retentive as possible, and in all respects as similar as possible in composition to a good fertile soil. In default of suitable substances for mixing, our whole dependence must be placed on the manure, and under such circum-

stances, care must be taken to select those least liable to waste. Farmyard manure will necessarily be the most important, and theory indicates that it ought to be employed in the unfermented state, because in that condition, its valuable constituents are least soluble, and consequently less easily washed away. It is true, the manure will act less rapidly on the crop than if it be fermented; but as the object is not so much to obtain a large crop, as to secure the permanent improvement of the soil, the addition to its retentive power is the main point to be attended to. In using artificial manures on such soils, those should be selected which contain their constituents in the least soluble condition, such as rape-dust, bone-dust, and animal or flesh manure; but salts of ammonia, dissolved bones or guano, should be used at first rather sparingly, and should, if possible, be applied as a top-dressing to the young plant when it is ready to absorb them, and not at the time of sowing when they may be washed out of the soil, before the crop is sufficiently advanced to make use of them.

In many instances, the infertility of the less retentive soils is due less to absence of the mineral constituents required by the plants, than to their existence in it in the form of compounds, so little decomposable that they are liberated and become soluble in quantities insufficient to maintain an abundant crop. This occurs not unfrequently in soils derived from granite, and still more commonly in those produced by the disintegration of mica-slate, which, in their natural condition, are the most barren of all soils. They are generally recognisable by the quantity of micaceous scales they contain, particularly if they are formed from the latter rock. Now, mica contains from 6 to 9 per cent of potash, a considerable quantity of magnesia, and sometimes a little soda; and hence a soil containing it ought to yield an abundant supply of these elements, if it were only possible to liberate them more rapidly than naturally occurs from their inert compounds. Lime and decomposing organic matters seem best adapted to fulfil this object. The former acts upon the insoluble silicates in which the valuable matters are imprisoned, apparently by uniting with the silica, and displacing potash and soda. The latter affords a continuous supply of carbonic acid, which is given off in immediate contact with these substances, and dissolves out lime, potash, soda, and magnesia, or such of them as are present in these minerals, which are naturally very difficult of disintegration, and on which the atmospheric carbonic acid acts very slowly, partly because it is extremely dilute, and partly because it does not come as closely in contact with them. Hence, if a crop be once obtained on such a soil, the elements of an increasing fertility are to a certain extent secured, because the vegetable matters left behind in the roots and other refuse parts of the produce during their subsequent decay, promote the decomposition of the mineral matters.

The establishment of vegetation on the surface of such a soil acts beneficially in another way, by retaining upon it a certain proportion of the mineral matters liberated by decomposition. For, so long as nothing grows upon it, the substances rendered soluble by the action of atmospheric air are carried off by the rain, and a continuous and steady deterioration is the consequence. But a growing crop absorbs and retains the greater part of these substances in proportion as they are set free; and even though it be removed, the soil is richer than it would have been had nothing grown upon it, because it must retain in the roots and leaves a part at least of those substances which would inevitably have been washed away by the rain had they not been absorbed by the plants. It is, perhaps, scarcely necessary to remark that improvement can be produced in this way only to a very limited extent, and that it is not possible thus to bring the soil into what may be called a state of practical fertility, although a certain amount of vegetation may be obtained from a soil which previously produced nothing at all. These considerations appear to me to point to green manuring as a system which might be advantageously resorted to in reclaiming waste land of this description; but though I have looked pretty closely through most of the published reports on the subject, I have been unable to find any record of its employment in this way. In green manuring, a crop is raised which draws the chief part of its organic nutriment from the air; and when it is ploughed, inorganic matter is accumulated in the soil, and the mineral matters, which the plants absorbed are retained in it, and become available for future crops, in place of being washed away; and as these are the objects which it is so important to secure in the class of soils now under consideration, it might be expected to act as advantageously upon them. It is, perhaps, scarcely necessary to observe that farmyard manure, independently altogether of the valuable matter it contains, exerts a very powerful action, by promoting the decomposition of the inert mineral compounds. But in this case it ought to be employed in a different condition from that recommended for the purely sandy soils, and should be in a state of active fermentation, in which its decomposing action is always most powerful.

The preliminary treatment of waste lands of the lighter kinds calls for no very special observation; nor can any definite rules be laid down which ought to be observed, for the plan to be pursued must depend on the position of the land. Draining may or may not be essential, according as the subsoil is retentive or not; so likewise trenching, which is required in many waste lands, is here less necessary, because the soil, being naturally porous, does not require such elaborate treatment. In fact, the mechanical operations necessary for reclaiming such soils are comparatively inexpensive, and it might be supposed that they afford a favourable

field for the purpose; but, on the other hand, it is to be noticed, that as they contain within themselves little or no natural stamina, a proportionate expenditure must be incurred in adding to them a sufficiently large quantity of manurial substances, a large proportion of which inevitably escapes from the soil without producing any effect. Hence, though such soils may be easily reclaimed, they cannot be kept in a state of fertility without a considerable outlay, and require a more liberal treatment than fertile lands.

Where the land possesses a more retentive character than those already discussed, it perhaps scarcely deserves the name of waste land, for it is seldom altogether valueless, but yields a small return as pasture land. Land of this description generally consists of stiff cold clay, more or less saturated with moisture, and thereby protected from the decomposing action of the air. Organic matters are generally deficient, but the inorganic plant-food is present, if not abundantly, at least in moderate quantity; while the clay serves to retain these matters, and any others which may be added to it in the form of manure. Its conversion into a fertile condition requires the admission of air: first, by thorough drainage; secondly, by trenching so as effectually to break up and expose to the air the whole of its mass. In effecting these operations it is necessary to keep in view that the defects of such soils are due, for the most part, to their texture being too close and retentive, and that the mode of reclaiming them is exactly the opposite of that to be used with light soils; a very important matter being the intermixture of some lighter or sandy soil. With this view the nature of the subsoil will be examined, and if it is found to be of open texture, care ought to be taken to carry the drains down into it, and to spread the lighter portion on the surface, filling the drains with the heavy surface-soil. Lime may be advantageously used where the soil is deficient in that element, because it assists in rendering it less retentive; but it is not absolutely necessary, and may often be dispensed with. The two great agents of improvement are, frequent working, so as to admit atmospheric air, and the liberal use of farmyard manure. Portable manures may also be abundantly employed, and they may be of the more soluble varieties, such as salts of ammonia, dissolved bones, or guano. The phosphatic manures, and particularly dissolved bones, ought to produce a good effect, for phosphoric acid is generally the element in which such soils are most deficient. In short, it will be noticed that the methods of reclaiming such land are exactly those which would be used in the improvement of inferior cultivated soils; and many of the so-called waste lands belonging to this class actually have at former times been cultivated, and allowed to go back into a state of nature. To enter in full into these points would therefore be to discuss the extensive subject of the general improvement of soils, which cannot be entered upon here. It will be sufficient for me to observe,

that after the first processes of reclaiming waste land have been effected, continuous attention to its management is requisite, so as to produce a steady and continued amelioration; for if after a few years the cultivation becomes careless, the land will retrograde, and finally return to its pristine barrenness. The improver of waste land should never forget that he must keep up a constant conflict with nature, not by opposing her laws, but rather by taking advantage of them, in such a manner as to alter the circumstances under which they operate; to substitute, in short, a fertile for a barren nature. It will readily be inferred from what we have said, that there is scarcely any soil from which a crop of some sort may not be forced by the abundant uses of manures; but the land will thus be left in a worse state than it was before, unless we at the same time seek to confer upon it the conditions necessary for permanent fertility. And for this purpose I believe nothing is more important than the judicious intermixture of soils of opposite qualities, an operation which has perhaps not received all the attention it merits, probably because of its expense,—a difficulty which can only be got over by carrying out improvements on a much more extensive scale than has hitherto been attempted, so that the use of temporary railways and other mechanical appliances may become possible.

In the actual practice of reclaiming waste land, there are many points, such as fencing, road-making, &c., which do not come within the scope of the present Address. But it is necessary to point out the great importance of sheltering the reclaimed land, which is often in exposed situations, by planting. Belts of planting should in all cases be formed along the sides of reclaimed fields, particularly in the direction of the prevailing winds; and where the soil is of a non-retentive kind, rows should be planted along the line of all the fences. I am aware that this latter statement is at variance with agricultural practice in Scotland, where a determined warfare is waged against trees, on the plea that their roots exhaust the land of substances which would otherwise be absorbed by the crop, and that they serve to shade soil. I do not doubt that this opinion is in many cases well founded, particularly where the trees are of the shallow-rooted species which do derive their nutriment from the surface-soil; but deep-rooted trees which penetrate into the subsoil, so far from exhausting, must rather improve the soil, because they absorb those matters which have descended into a stratum below that into which the cultivated crops send their roots, and these elements are accumulated chiefly in their leaves; and in autumn the greater portion of them are again deposited on the surface of the soil, with the exception of a very small quantity which is permanently retained by the wood. The deep-rooted trees, in fact, form one of those compensating means which nature so often employs, and are silently performing a work which never

attracts our attention, and husbanding for us manurial matters which would otherwise be wasted.

I have thus attempted to point out as concisely as possible the chemical principles concerned in reclaiming waste land. Into the practical details I have not attempted to enter, for that is a subject on which I ought rather to receive than to give instruction. I may be permitted to remark, however, that in all the most successful cases of the improvement of waste land, the principles now pointed out have been pretty closely adhered to in practice, and that, however numerous the modifications required in different localities, their principles are always the same.

In conclusion, it is only necessary to refer to the collateral advantages of reclaiming waste land, dependent on the improvement of the climate of the district. As the operations in many instances consist in the conversion of bogs or stagnant water into dry soil by drainage, there is thus removed one of the most important causes of low temperature in the adjoining district, and a marked effect is produced in this way when the extent of surface reclaimed is large. We may add, also, that it has a moral effect, and stimulates the agricultural energies of the neighbourhood; for no man who sees abundant crops produced on what was once a barren waste, can fail to ask himself whether his cultivated land has reached the highest state of fertility, and he is then inevitably led to adopt a higher and more remunerating system of farming.

IMPROVEMENT OF WASTE LAND.

By Mr URQUHART FRASER.

[Premium—The Medium Gold Medal.]

[The following Report is printed as appropriate to the subject of Dr Anderson's Address, and as an example of the improvements which are being effected in many parts of Scotland, by the energy and perseverance of the smaller class of tenant-farmers.]

I BEG leave to submit, for the consideration of the Directors of the Highland and Agricultural Society, the following report regarding improvements carried on by me on the Croft of Skillmafilly, Parish of Tarves, district of Formartine, and County of Aberdeen.

I entered upon the Croft of Skillmafilly at Whitsunday 1848, under an agreement made with Mr Brebner, factor for the Earl of Aberdeen (on whose property the croft is situated) for a lease of nineteen years. The rent originally was £5 per annum; for the last six years I have been paying £11, and for the remainder of the lease I shall have to pay £15. The Hill of Skillmafilly lies about 600 feet above the level of the sea, with a southern, western, and northern exposure.

It was, at the date stated, a bleak and barren spot, being mostly

covered with whins and heath (more especially the former), and some bushes of planting, which although only about 4 feet in height, had been nearly forty years in the ground. The hill, indeed, in an agricultural point of view, was of no use whatever, and served merely as a rabbit-warren, it being completely overrun with these vermin.

The upper soil of the hill is of a blackish light sandy nature; about 6 inches deep, where it had not been cast off for turf and other purposes. The subsoil is of various qualities; some portions of it being composed of a stiff sandy clay, containing a great many stones; while at other places large bars of shaken rock run from east to west across the hill; and in other quarters you find hard reddish sand, with a muirband pan varying from the thickness of a shilling to 4 inches in depth. The subsoil, moreover, is all very much impregnated with oxide of iron, which has destroyed the planting.

In commencing my improvements, the first thing I had to do was to build a new steading, the old houses being in an almost ruinous condition. In 1849 I began my land improvements in good earnest. The farm is not so well laid off as it might have been, had no obstruction existed. There was, however, a zigzag old county road which came in the way, the course of which interfered with part of the ground of the present garden, the west wing of the court, the mill-dam, and a part of one of the fields. I gave considerable assistance in changing the line of this road, and incurred expense in altering and shutting up by-roads. To give a minute detail of all my operations in reclaiming land would be tedious, as I had frequently three or four fields under improvement at the same time; in one trenching, in others trench-ploughing, taking up stones, pulling brushwood, &c. At the outset of my operations I had also different kinds of crop growing simultaneously—oats, turnips, potatoes, &c.; fallow, after trenching, for a year, where it was found most difficult to get the muirband pan pulverised, and the small stones, of which there was no end, both in the upper and subsoil, taken off. It is but right that I should state, however, that there were few blocks so large that blasting was necessary. Of the 105 acres comprised in the farm, 27½ have been trenched at an average cost of £7 per acre; while the remaining 77½ acres, ploughed, have cost, on an average, £2, 5s., previous to being touched by the plough, and this exclusive of draining. Grubbing whins cost me, on an average, 30s. per acre—gathering and burning them, 10s. per acre; while the taking up or "holeing" stones, came to about 5s. per acre.

As the above may be considered a somewhat heavy rate to pay for grubbing, it may be as well for me to state the reason for this high figure, by explaining how the operation was done. My grubbing was performed with an instrument about 20 inches in length, having an "eye" in the middle, into which was put a shaft similar

to that used in picks. One end of the instrument was used for removing stones, while the other end was fashioned into a hoe for cutting off the main root of the whins some two or three inches below the surface of the earth. Had it not been for the instrument just described, and the brawny arms of the navvies who wielded it, I am safe to say, that small would have been the extent of the Hill of Skillmafilly reclaimed by me or any one else without having recourse to the pick and shovel. Three horses abreast were able to make tolerably fair work after grubbing in the manner noticed, where, without this operation, six horses would have had little effect. Nearly all the reclaimed land required three yokings per acre, besides one yoking of the break-harrow, costing, per acre, at least 24s.

In laying down the first crop upon new ground, I gave to each acre not less than 4 cwt. (sometimes, indeed, as much as 4½ cwt.) of the best Peruvian guano, with 8 bolls of English shell-lime; and in return I have had, on an average, 3 quarters of oats per acre, except in seasons 1850 and 1853, when my crop on new ground was a complete failure, in consequence of the early drought. Crop 1855 yielded about 3½ returns. I fully expected 6 returns from crop of 1856, but my prospects of remuneration are not at present very bright, owing to the unfavourable weather during harvest. I had to drive the greater part of the crop out, after being stacked, and to place it in small cocks, to prevent heating and rotting: I thus lost much of the best grain, and the corn-merchants are only offering me for the remainder 16s. per quarter. In my turnip husbandry, again, I have not succeeded so well, although I gave this crop at least 16 bushels of mixed bones, 2 cwt. of Peruvian guano, and 20 cart-loads of farmyard dung per acre. My turnips always came up beautifully, and continued to look well until after the second hoeing, when they began to die—many of them rotting. I am inclined to ascribe this to the effect of the pernicious "pan" previously referred to, as the turnips are always worst in the places where the "pan" appears strongest. I am in hopes, however, that after the land has been in lea, and receives a top-dressing of lime before being broken up, I will succeed in raising better turnips; if not, my improvements will turn out a bad speculation.

With regard to drainage, I have to state that into one field I put 1200 yards of 5-feet deep drains, with a large stone eye 6 by 10 inches, costing 3d. per yard; into another 315 yards of an average depth of 7 feet, with a stone eye 7 by 12 inches, at a cost of 5d. per yard; in a third, which had a mossy hollow extending to about 2 acres very wet and boggy, 1530 yards 6 feet deep, at a cost of 2½d. per yard.

So much has of late been said on the subject of moss improvement, that it would almost be impossible for me to say anything regarding it, important or new. Let me just note, therefore, as my opinion, that farmers who are favoured with a rich vegetable

moss will find their best plan to be to drain and take away the bottom water, plough or delve, give a moderate quantity of lime, and not overcrop. If the moss is very deep and very tough, or a black coal moss, the only method of successfully reclaiming it is to cart on a change of soil from four to six inches deep. Some thirty years ago I found this to be a sure way of reclaiming deep moss of a bad quality. It is now nearly three years since I commenced improving part of a field in which there are 2¼ acres of boggy moss, about 2 feet in depth, lying on a bottom of miry clay, and into which I have put 820 yards of drains, from 4 to 7 feet deep, at a cost of 4d. per yard. I know that the fashionable depth of drains is 3 or 4 feet, but I made mine the depth mentioned, knowing that a deep drain, if put in a proper place, will draw at a great distance, and a good current of water keeps the drain open, and is not so liable to be run with moles or choked up with sediment; and being further of opinion, that a drain of 6 or 7 feet in depth, if properly constructed, will last a hundred years or more, whereas a drain of 3 or 4 feet depth will, in many cases, be found useless in a comparatively short period. On the latter point I speak from some experience. Deep drains of the kind I have been speaking of can only be cut about the month of August, and after harvest, or previous to the rains in autumn. I have known 200 yards of a deep drain, put in at the time referred to, do more good than 1000 yards of 4-feet drain made in the dead of winter. Winter for trenching, and summer for draining, I have found to be the best rule to abide by in carrying on these operations. I do not think money could be more fruitlessly expended than in improperly-constructed drains. If deep drainage, deep culture, and plenty of good manure do not produce good crops, the soil must be to blame; and proper drainage, culture, and manure will improve the worst soil. I would be glad if I had more use for drainage and less for whin-grubbing: the only turnips I have had that could be called a crop have been on the drained patches referred to.

Since 1849, I have brought into regular cultivation the 105 acres referred to, as also a third part, at least, of the 25 acres of an old croft, which, being entirely overgrown with whins, had to undergo grubbing and ploughing with three horses, and thus cost me a considerable sum of money.

I now append statement of the principal items of expense in reclaiming 105 acres on Hill of Skillmafilly:—

To trenching 27½ acres, ...	£192	10	0
... clearing, ploughing, and harrowing remaining 77½ acres, ...	257	7	6
... drainage, ...	51	3	4
... liming 85 acres, at 24s. per acre, . .	102	0	0
(Cartage is not included in this item).			
... 5000 yards stone dyking, at 10d. per yard,	208	6	8
Total, . .	£811	7	6

Besides this in land improvement, I had to expend upwards of £500 in erecting a new steading of houses. I also expended £40 in cutting and embanking a mill-dam; and I had to construct a water-course of 450 yards. With the exception of slates, I received no aid in my operations from my landlord.

These calculations are made up to the 25th March 1856; and while I trust they will, with the foregoing statement, satisfy the directors of the Highland and Agricultural Society that much has been done on the Hill of Skillmafilly, yet I am bound to add, not a little lies to be still effected in the way of improvement. When the extent of my farm and the amount of my rent are contrasted, I may appear to be pretty snug with but £15 to pay; but if my accounts for manures, tradesmen, tear and wear, &c., and interest on money expended by me be computed, they will of themselves form a fair rent. For the last five years I have laid out from £90 to £100 annually on manures, and crop 1856 cost me, in guano, bones, and lime, £136, 9s. With fair encouragement, however, I am anxious and willing to continue as I have gone on hitherto; hopeful that at no distant period I may reap a fair return for my money and labour.

REPORT ON THE SAVING AND APPLICATION OF THE LIQUID MANURE OF A FARM.

By Mr JAMES PORTER, Land-Steward, Monymusk, Aberdeenshire.

[Premium—The Gold Medal.]

THE term "Liquid Manure" is in some degree applicable to all kinds of manures by which vegetation can be successfully promoted, as all plants imbibe their nourishment in a liquid state, and may therefore be said to feed solely on liquid manure. From this simple fact, it then becomes at once evident that the farmer can have no better means of increasing his crops, than adding to them a due proportion of that food so readily assimilated by plants, and which can be had in abundance within every farmyard in the country, for the trifling expense of collecting. It is the liquid manure of the farm which is here purposed to be spoken of, consisting of the urine of man, horses, cattle, and swine, all drained into one common cesspool. It can then be made available to all crops in some shape or other, and rendered a highly important and cheap auxiliary to the other manures of a farm. In very many cases this valuable substance has hitherto been grossly neglected, and perhaps less economy shown in its preservation and use than in any other branch of British husbandry. If the results found by chemists in the laboratory hold good in practice in the field, the following brief sentences will show that the urine wasted in this country must be worth an enormous sum. "Liebig tells us that

1 lb. of urine should give 1 lb. of wheat, and that every pound of ammonia which evaporates is a loss of 60 lb. of corn. Johnston puts down the urine of a cow at 1200 or 1500 gallons a-year, and the solid matter given off by a healthy animal in this form, in the same time, at 900 or 1000 lb. weight—worth, if it were in a dry state, from £8 to £10 sterling." These are startling statements, and when advanced by such high scientific authorities, must be an incentive to the agriculturist to turn his attention to the more extended use, and general preservation, of the urine of the farm. With all deference to the opinions of these gentlemen, I have been engaged in trying practical experiments with the urine of the farm since 1840; sometimes with the ammonia fixed and sometimes not, sometimes in the fresh state and sometimes fermented; and although often with good success, as will afterwards be shown, yet never with such high pecuniary results.

I make little pretensions to the knowledge of chemistry, and therefore will not attempt to give any detail of the many ingredients of which the different kinds of urine are composed, but for these particulars refer the reader to the works of Liebig and Sprengel, where full analyses of the different kinds of urine may be seen; all chemical formula I shall also dispense with, and try to steer clear of the labyrinths in which, to the unscientific, men of science sometimes appear to enclose themselves, and render their meaning to many a farmer difficult of apprehension. The preservation or application of liquid manure is, at the best, an unpleasant concern, which circumstance, no doubt, makes the farmer the more careless of it than he otherwise would be if it were anything like agreeable work. Farmers, in general, are plain men, and like to be plainly spoken to; they hate the plan of working things too closely, by grains, and scruples, and hundreds of parts of a pound; so I shall therefore endeavour to show that urine can be profitably applied to the land in a farm mostly workable with spades, shovels, and graips, and thus have greater hope that my plan will be more generally adopted.

A detail of my experience in the management of the liquid manures of a farm may be best comprehended in the following forms, viz:—

1st. Description of tanks, and mode of conveying to them the liquid, and the period for which it should be kept.

2d. The mode of applying the liquid to the land, either by itself, or along with the dung, or with compost.

3d. Original outlay for works, and the cost of maintaining them, and distributing the liquid, the returns actually obtained, and the profit of the whole process.

First. The erection of tanks, and the drainage of the urine from the feeding-houses, can no doubt be much facilitated by the way in which the steading is set down. It then becomes matter of importance in the erection of new steadings that these objects be

always kept in view, and attended to, in so far as can be accomplished, without any material interference with the external or internal accommodation of the buildings. The houses from which the liquid is to be collected should be built as compactly and near to each other as circumstances will permit, thereby shortening the length, and diminishing the cost, of the drainage.

When the adjoining ground slopes quickly from the steading, the tank may be so constructed that the urine may be forced from it into the cart by gravitation; but, as level ground is always most desirable for the site of a farm-steading, it is seldom that this plan can be conveniently effected. Sometimes it could be managed by conveying the urine to a suitable place in pipes; but rather than do so, to any considerable length, it would be better to sink the tank in the bottom of the dung-pit, near the doors of the feeding-byres, and load the cart by means of a pump. In general, it will be found that the dung-pit is the best place for the tank, as much of the urine can be profitably used there in watering the dung or compost heap. For the safety of the dung, the pit should, if possible, be placed on the north side of the farm-steading, and sheltered round on the other three sides by a close stripe of shrubbery or thick planting. Nothing is more injurious to dung than to be exposed in dry spring weather to the scorching influence of sun and wind. In bygone times it was the prevailing practice to have the dunghill placed on the south side of the houses—not in a pit, but generally on a piece of uneven and sometimes high ground, as chance threw in the way, rather showing a wish to have the manure properly dried, than to preserve it in its natural sap. But such farmers, we presume, are nearly gone, and with them, we trust, their mode of farming. To prevent an overflow of rain-water in the dung-pit, the eaves of the houses should have good water-spouts around them, and the adjoining ground formed in such a way as to prevent surface-water from running into the pit.

So much for the site of a steading, as far as the economy of manure is concerned. The construction of the tanks, and the drainage of the liquid, are the next points to be considered; and in these particulars I shall follow the plan of construction adopted on this farm, which has been in use for nine years, and found suitable. The farm contains 180 acres, about the half of which is very poor soil, but it has improved much, and generally produced well, since the economy of liquid and other manures received due attention. The course of cropping pursued is the six shift—2 grain crops, 3 grass crops, and 1 green crop of turnips, potatoes, and tares. The average number of stock kept is 50 to 55 cattle, 10 horses, 12 swine, and 4 to 5 score of sheep. Besides keeping these, which have always been full fed, there has generally been a field or two of grass, and sometimes 8 or 9 acres of turnips sold off the farm. Most of the horses were fed in the house during the year; and the cattle are grazed in the fields for fully five months. This

will give some idea of the produce of the farm, which, of course, must affect the quantity of urine—the gross total of which, annually collected in the tanks, is about 24,000 gallons. The animals are always well littered with straw, which no doubt carries much of the urine along with the dung.

The dung-pit forms a parallelogram, 75 feet long, 40 feet wide, and 3½ feet deep below the surface of the contiguous ground, and stands lengthways in front of the feeding-houses. It is built round with a retaining stone-and-lime wall, causewayed in the bottom with pebble stones, with a gentle slope from the byres to the farthest corner, where there is a tank for receiving the waste liquid that may happen to part with the dung, as also the refuse water from the kitchen and the piggeries, which are close by. The tank for receiving the liquid from the feeding-houses is placed in the bottom of the dung-pit in the centre, and close to the retaining wall next the steading. I believe there are two of these tanks, as it was thought best that the urine should be taken from the one whilst that in the other was undergoing fermentation. The dimensions of the two are 27 feet long, 6 feet broad, and 5 feet deep, = 810 cubic feet; capable of containing about 5048 gallons, or 27 tons of urine. The stratum from which the tanks were excavated was of a dry gravelly nature, and fears were entertained of the liquid escaping; to prevent this, the bottoms were puddled with clay, and closely laid with Caithness pavement. The sides are constructed of large pieces of the same material, set on end, so as to fill the whole deepness of the tank, and firmly bishoped up at the back with good clay. The tops are covered with the same kind of flag, and the whole joints of the pavement around the tanks, above and below, are closely pointed with Roman cement. The bottom has a gentle incline to one end, where is a small recess in the pavement for receiving the end of the pump, and to which the last of the liquid flows when the tank is empty. There are metal agitators with flys placed in the tanks, moved by hand-cranks outside, which stir all deposit in the bottom, and fit it for pumping up. By the use of this simple apparatus when the pumps are working, it is wonderful how little sediment collects in the tank; it has only now been cleared out for the first time in nine years, and a barrow-load would have lifted the whole. Two privies or water-closets discharge their soil into the tank, which must add much to the strength of the mixture. The tanks are perfectly impervious to water; they hold in and hold out, and are almost air-tight; a small aperture can be opened at pleasure, where sulphuric acid may be poured in if wished.

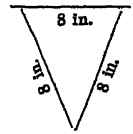
The other tank for the waste urine from the dunghill, &c., is of a less costly description; erected in a circular form 10 feet diameter, and 7 feet deep, = 550 cubic feet; capable of containing 3427 gallons, or about 18½ tons weight. The way in which the tank was constructed was this: When the pit was excavated, a

puddle-wall of clay was laid in its bottom about 12 inches deep, firmly beaten down and causewayed over with pebble stones. The sides were then built round with a rough stone-and-lime wall 18 inches thick; and as the building advanced, a puddle-wall of clay, the same thickness, was carried up between it and the bank. The pump was then set in the side next the dung-pit, in a hollow in the bottom left for receiving it. The tank was then laid over with a close covering of strong rough wood, as far below the adjoining ground as admitted of 6 inches deep of gravel being laid over it. As more sediment was expected to collect in this than the other tanks, a trap-door was put in to allow its being cleared out. The tank of itself is perfectly close, and as suitable for the purpose as could be desired. The wooden covering is no doubt perishable, and will at times cost some expense in renewing it, but that will only happen at considerable intervals, as wood lasts for a long time below ground. I have constructed several oblong tanks in this way, and always found them to answer the purpose well: with plenty of good clay well puddled in, it is quite practicable to make them perfectly water-tight, and as suitable for preserving urine as cemented tanks constructed of pavement or the best built ashler work. It may be all well for proprietors and men of capital to erect expensive buildings of this sort below the ground, but for farmers with a short lease and a long rent it is quite another matter. Their great object must be convenience, at the least possible expense, and for that reason I should recommend the last-mentioned description of tanks as the most suitable for the public good. It might, however, be made oblong in place of circular, and then the size could be increased at pleasure. In the above case the strata below are dry and gravelly, and no underground-draining was required; but where the ground is wet and spongy it ought always to be deeply drained around all dunghills and urine-tanks.

The pumps, which were made of larch-wood, have stood but very indifferently; in the short space of nine years they have almost become inefficient; not so much decayed as twisted and rent by the drought, and thereby rendered in a measure useless. Larch-wood is very subject to twist and rend, and for that reason I think Scotch fir more suitable. A good matured Scotch fir-tree is undoubtedly the best for pump-wood. It is desirable that all wooden pumps, as far as they stand above ground, should be cased in a wooden box of inch-thick boards, which I find to be a complete preservative from drought, and likely to prolong the endurance of the pump. Wooden pumps are preferable to metal ones, as they are little subject to corrosion, and of course better adapted for urine-tanks. These pumps are of 4 inches bore, capable of throwing a ton weight of urine into a cart in ten minutes with all ease.

Drainage.—The drainage of the urine from the feeding-houses to the tank is perhaps the nicest part of the whole business,

urine being so apt to collect sediment that the least obstruction in the drains would very soon create a stoppage; it is therefore of importance that the drains should be clean and smooth in the inside, and laid in lines as straight as possible. Various descriptions of these have from time to time been used, but I shall only describe a few of the sorts of which I have had experience. 1*st*, Brick conduits formed according to the figure annexed, built on the sides with angular bricks made for the purpose, covered over with squared flag-stones, and the whole joints closely pointed with Roman cement.



When neatly done this makes an excellent clean running drain, but it is rather more costly than a 4-inch clay-pipe. 2*d*. Three boards, 8 × 1, put together so as to form a conduit of the last-named description, planed inside, and the joints filled with white lead. The urine runs as clean off in this sort of drain as in any I ever tried; and, but for its perishable nature, it deserves commendation. I have known it, however, to last for a good many years, and on account of its cheapness, and where wood is plentiful, it is, at least, worthy of a favourable notice. 3*d*, Wooden pipes with a bore of 4 inches diameter fitted into each other with white lead. But as all bored sticks are full of rags inside, which render them ill adapted for drainage of any sort, and more so for urine, which is of a sticky nature, and which, if meeting with inequalities in its course, is very liable to get choked up. I never found these to answer for any length of time, even for clean water, and shall, therefore, dispense with them, as unsuitable for this operation. 4*th*, Clay pipes of a 4-inch bore, glazed inside, and fitted tightly into each other with good milled clay, make perhaps the best drain ever yet tried, for the liquid-manure drainage of a farm. The drainage here has been all done with this kind of pipe, and for many years has effectually answered the purpose. I believe there could be no better description of drain than this, combining as it does, efficiency, cheapness, and durability.

The drains for the pipes run on lines from end to end of the feeding-houses, and are joined with bended pipes, into one centrical main drain, leading to each tank; their average depth is about 2 feet, with a fall in the bottoms of 3 inches on 20 feet towards the tank. In all drainage a good fall is very desirable, but more so in liquid-manure drainage, as it keeps the liquid moving onward, and so far prevents a lodgment of sediment in the pipes. Cesspools of cast metal are placed at regular intervals along the *greeps* of the stables and byres, and also below the belly of each horse, in the middle of the stable stalls: these are about 8 inches square and 18 inches to 2 feet deep, with perforated holes opposite the pipeage for allowing the liquid to flow along. Perforated metal gratings are fitted on the tops of the different cesspools; they are better and cheaper than split branders of iron, as they keep back straws and all rough materials. In building stone cess-

pools in byres, care should be taken to sink them well, so that, when finished, the metal-grating on the top may be considerably below the adjoining causewaying of the byre; otherwise the grating above the cesspool will soon be the highest place in the greep, which is often the case in the best fitted byres, thereby making the egress for the urine uncommonly awkward. The masonry about the cesspool on a firm foundation, will, of course, stand up as it was built; but the adjoining causewaying, set in sand or other loose materials, tends to sink in course of time, however firmly it may have been bishoped down. The pipes are all laid in puddled clay, and packed over with the same material; the drains then bishoped full of rubbish, and causewayed with pebble stones along with the rest of the byre.

The best urine-drains that can be constructed need due attention to keep them clean, and for that purpose a good scouring with clean water is the best thing that can be applied. It is, therefore, essential for such drainage that a supply of water be always at hand. The cesspools should be cleaned out at least once a month, and a good current of water sent down the drains, which would serve the twofold purpose of cleaning the pipes and diluting the liquid in the tanks. With due attention to these simple precautions, I am pretty sure that no stoppage from sediment will ever take place in this kind of drain, for my own experience has brought me to this conclusion. If tanks are constructed to keep in the liquid, the roughness of their workmanship matters not; but with drains it is quite different, for if they are not clean and carefully laid, free from all unevenness inside, they are very unlikely to answer their purpose for any lengthened space of time. For the drainage of ordinary-sized steadings, the 4-inch pipe is sufficiently large, but the diameter of the bore may be increased or diminished at pleasure, as the extent of the steading and the probable quantity of urine may require. A considerable saving might be judiciously effected by using pipes of a different diameter—say 4-inch pipes next the tank, 3-inch pipes in the middle, and 2-inch pipes at the upper end of the drain, where the quantity of urine must always be least. This system of pipeage would answer perfectly well, and I presume the cost would also be diminished, as every inch the diameter of the pipe is lessened makes a saving of fully twopence a yard.

The period for which the urine should be kept must depend much on the after use to which it is to be applied. If it is to be mixed in composts of vegetable mould, moss or black earth, which are excellent absorbents, and well adapted for fixing the gaseous and volatile parts of urine, I should then apply the liquid in its fresh state; but when it is intended to be spread over the young plants, either of grass or corn, I should by no means do so. It is evident that urine, in its fresh state, is apt to scorch the tender plants, unless it were applied in rainy weather; and on land

abounding in vegetable matters, this fact may be clearly elucidated, by observing the urine of the cattle as dropped in the fields. In wet weather, and on rich pasture lands, no injurious effects from the urine can be traced; but in scorching sunny weather, and on dry gravelly soils, with a scanty herbage, the brown scorched spots where the urine has been dropped are at once perceptible. Urine in its fresh state can never be taken up by plants, till it undergo a certain chemical change, known by the name of decomposition; and when applied to poor gravelly soil, void of organic or vegetable matter, it is not retained long enough for its putrefaction taking place. It is put on in the name of liquid manure, and runs off nearly in the same state; hence the cause of so many failures in its application. When the manure is to be applied to the crops in a liquid state, it should be left in the tanks for a month or five weeks, when the necessary change will have taken place, which may be promoted, and the ammonia completely fixed, by sulphuric acid or gypsum (sulphate of lime). As sulphuric acid is seldom of one strength, no precise quantity can be stated exactly for fixing the ammonia in urine; but on trial I find the average quantity necessary for that purpose to be a half cwt. of acid to 1000 gallons of urine. The only sure rule, however, is to pour acid into the urine until the effervescence stops; or to get a piece of grey litmus-paper (which almost any druggist can prepare): dip it in the urine, and if the liquid redden the paper, there is a superabundance of acid, but if the paper turn blue the ammonia predominates. When there is no excess of either substance, the ammonia may be said to be fairly fixed, and the paper will retain its original colour. When the ammonia in the urine is thoroughly neutralised by the acid, it may immediately be applied as a top-dressing to almost any crop; but I have always found its effects to be most immediate and useful when applied to the crops in soft, damp, and rainy weather.

Second, The liquid manure of the farm may be advantageously put upon the land in various different forms according to the season of the year, the state of the weather at the time, and the crops to which it is to be applied. At one time I used it, chiefly in the liquid form, as top-dressing to grain and green crops, particularly to new grass; sometimes with good results and sometimes not. The state of the weather affects it so much, that when drought set in immediately after it was spread, I have often seen a dressing of from 2000 to 3000 gallons per acre, do little or no good, even when the ammonia was properly fixed with the sulphuric acid. The only way I ever succeeded in making a direct payment from top-dressing with urine alone, was by applying it to new grass in spring, and that only in damp rainy weather. I found it to withstand drought better when diluted with two or three times its bulk of water; but that cannot be carried out profitably, to any extent, without the aid of steam power.

In the dry months of spring and summer much of the liquid may be used with advantage in pumping it over the dunghill. I have adopted the plan for a long time back, and am convinced of its excellent efficiency. Dung treated in this manner never fails to produce good crops, and the urine contained in it must be ready food for plants, in the first stages of their growth; besides, it can be carried to the fields in a portable and easy form, with little or any extra labour. Some may be ready to conclude that the urine should all be sent to the fields along with the dung; to such I would say, this would undoubtedly be the easiest way if the dung would carry it. But with the quantities of turnips now consumed, the dunghill would scarcely retain the half of the liquid manure of a farm, even although regularly spread over it in the most careful way.

In disposing of the liquid in winter, or at any other time when it can be spared, I have always found it best to mix it in vegetable matters, mould or moss, which should always be prepared a year before, in order that it may be thoroughly decomposed. In forming a compost-hill, the only thing worthy of consideration is, to render the carting of the materials as easy as possible. Well prepared compost, properly saturated with liquid manure, is adapted for all descriptions of crops, and seldom fails to produce a remunerative return on all soils and in all seasons. I am therefore strongly of opinion, that the liquid manure of a farm cannot be applied to the soil in a better form than by mixing it with the dung and other fertilising matters. In fixing the ammonia in dunghills gypsum is perhaps the preferable thing, for a slight sprinkling of this, particularly in dry weather, has a wonderful effect in retaining it; and moreover, the low price at which it can be got is a strong recommendation in its favour. I have often used it for this purpose, and fully believe that it paid me well. I object to sulphuric acid as a fixer of ammonia, solely on account of its exorbitant price.

Third, The next and most important point to elucidate is the the profit of the process herein described. I shall, therefore, give in detail the whole cost of the works already alluded to, compared with the returns actually obtained, viz.:—

To cutting the foundation of 2 cemented tanks,	£1	5	0			
... cost of materials, carriages, and building do.,	18	0	0			
... metal agitator and 2 pumps, . .	3	1	0			
				£22	6	0
... cutting the foundation of 1 circular tank, .	£1	1	0			
... cost of masonry, and cost and carriage of materials,	4	0	0			
... metal agitator, 1 pump, and planks for covering tank, ...	2	15	0			
				7	16	0
... cutting 198 yards of drains 2 feet deep, at 1d. per lineal yard, including making of cess-pools,	£0	16	6			
... 198 yards 4-inch clay-pipe, glazed inside, at 1s. per running yard, . . .	9	18	0			
Carry forward, . .	£10	14	6	£30	2	0

Brought forward,	£10 14 6	£30 2 0
To carriage of do.,	1 8 0	
... laying of the pipes, carriage of clay, and filling in of the drains, including fixing in of cesspools,	1 18 6	
... cast-metal boxes for cess-pools, including perforated metal-gratings for covering them,	4 4 0	
... cost of a leather nozzle for conveying the liquid from the pumps to the cart,	1 5 0	
... cost of an iron scoop for cleaning cess-pools,	0 1 6	
... cost of a cart for driving the liquid,	6 10 0	
... cost of a small pump for pumping the liquid from the cart on a compost-hill,	0 10 6	
... cost of wooden spouts for tracing the liquid over the dung and compost hills,	0 6 0	
		26 18 0
Total original outlay for works,		£57 0 0

As most of these works are of a permanent character, calculated to last for a long space of time, it may be reckoned a fair return for the capital expended, to charge on it an annual interest of 5 per cent. To meet the annual expenditure in maintaining the works, a sum of £1, 10s. will be amply sufficient, for, excepting the cart, the pumps, and the spouts, the other appendages can need little repair.

About one-half of the urine annually saved here, (12,000 gallons) is applied to the land along with compost, in various quantities, according to the quality of the land and the crops to be raised. I shall now give in detail the cost of applying the above 12,000 gallons, compared with the increased value of the crop thereby obtained; and in order to approximate as near the truth as possible, I have averaged the increase of five successive years.

COST OF THE APPLICATION TO AN OAT CROP AFTER LEA ON 12 ACRES OF LAND.

By cost of collecting, making, and laying on 240 yards of compost, at 1s. per cubic yard,	£12 0 0
... a man and horse carting urine 60 hours,	1 10 0
... a man occasionally working agitator in tank,	0 5 0
.. half the interest on original outlay for works (£57), at 5 per cent per annum,	1 8 6
... half the estimated annual cost of keeping the works in repair,	0 15 0
Total cost of applying the liquid,	£15 18 6

To an average increase of crop obtained by such an application, 2 quarters 1 bushel per acre, or 25 quarters 4 bushels on the 12 acres, at £1, 5s per quarter for oats and straw,	£31 17 6
Less cost of harvesting, at 1s. 6d per quarter,	1 18 3
Value of increase of crop from the 12 acres,	£29 19 3
From which deduct cost of the application,	15 18 6
Showing a clear profit on the 12 acres, of	£14 0 9

Although I have only charged the compost at 1s. per yard, it will generally cost about 3d. more; but I consider that sum will be more than compensated by the after-benefit conferred on the land.

The expense of distributing urine in compost must vary according to circumstances—the distance the compost has to be collected, and the quantity of it applied to the land. In this experiment, the soil was poor and gravelly, and much in want of a mixture of vegetable mould. But on soils of a rich alluvial nature, one-third of this compost would be quite enough. In fact, I should never give it more than sufficient to carry the necessary quantity of urine to the land, which, of course, would lessen the cost of distributing the liquid to a very considerable extent.

The other half of the liquid (12,000 gallons), I have generally disposed of in watering the dung; and, after repeated trials with dung made in this way, compared to that unwatered with urine, I have found the following average results on the turnip crop—

The quantity of dung to which the liquid was applied was about 400 cubic yards, spread over 24 acres of turnips.

COST OF DISTRIBUTING THE LIQUID.

By carting 6000 gallons of urine to dunghills in the fields,	£0	15	0
... a man occasionally working agitator in the tank, .	0	2	6
... pumping 6000 gallons of urine over the dung in the pit,	0	3	0
... a man working agitator in the tank, ...	0	2	6
... half the interest on original outlay for works (£57), at 5 per cent per annum, ...	1	8	6
... half the annual cost of keeping the works in working repair, ...	0	15	0
Total cost of distributing the liquid, .	£3	6	6

To increase of produce on 24 acres of turnips, arising from the application of the liquid to the dung, at the rate of three tons of bulbs per acre, equal 72 tons of turnips, at 7s. per ton, ...	£25	4	0
From which deduct cost of applying the urine, . .	3	6	6
Leaving a clear profit on the 24 acres of turnips of .	£21	17	6
To which add profit on the other half of the urine applied with the compost, ...	14	0	9
Total profit on the year's urine, .	£35	18	3

Or an item of nearly 4s. per acre over the whole farm.

From these statements it may readily be seen that the urine-manure of the farm is easiest managed and pays best when mixed with the dung; but as there will generally be plenty to do to carry

the half of the dung to the fields, we must therefore dispose of the remainder some other way. The next best mode I have found is to mix it with composts, as before described; and this is doubtless the preferable plan for all soils of an inferior description. When compost, however, is difficult to get, and the land of a fair average nature, the urine may then be applied in the liquid form to new grass or corn early in spring, and always in damp rainy weather. By giving a dressing of 2000 to 3000 gallons of the liquid, I have sometimes succeeded in increasing the hay crop to nearly double the average quantity; but the nature of the weather affects it so much, and it is so difficult to regulate its application, that I think it better to dispense with the system as far as possible, and to mix the urine with the dung and the compost heaps.

The saving and application of liquid manure has of late been a subject of much public discussion, and some enthusiastic agriculturists would have all farm manures liquified, and applied to the land by steam. The principle of itself may be all very good, although of this I confess I am somewhat sceptical. Liquid manure tends to make soft crops, and plants do not require all their food ready prepared at once, but prefer it by degrees in the different stages of their growth, which well-prepared dung seldom fails to supply. The out-and-out liquid manurers never tell us where all the capital is to come from, necessary for such an undertaking. Something like £4, 10s. per acre is, I believe, their estimated cost for setting the whole machinery agoing, which would incur an expenditure on the arable acres of Scotland, at present under rotation, of fully fifteen millions of money! possibly rather more than the present state of our agricultural finances would be able to bear. This looks something like putting the cart before the horse. Just as well tell a man at once that we can do nothing for him, as to tell him of a great profitable undertaking he is never likely to realise. The form of liquid-manuring which I have now detailed, is within the reach of the great majority of farmers, and if practised by them will doubtless pay them for their trouble. At all events, it may serve as a stepping-stone to a more complete and profitable system of the management of the liquid manure of a farm. As I have already shown, the system is perfectly workable, has paid me well, and shall now be left to practical farmers, who may judge of its usefulness, and the propriety of its general adoption.

AGRICULTURAL STATISTICS OF SCOTLAND, 1856.

HIGHLAND AND AGRICULTURAL SOCIETY,
Edinburgh, 12*th December* 1856.

SIR,—I have the honour of presenting to the Lords Commissioners of Privy Council for Trade, the concluding Report on the Statistics of Scotch Agriculture for 1856, embracing—

I. Amended Table of acreage under tillage.
II. Proportional acreage of the crops in each county.
III. Estimate of gross produce, in bushels or tons, of the principal cereal or root crops in each county.
IV. Estimate of the average acreable produce of the same crops in each county.
V. Estimate of average acreable produce in each district, or subdivision of a county.
VI. Estimate of the weight of the cereal crops in each district.
VII. List of districts; and Reports by Enumerators on the quality of the crops.

I shall endeavour, as briefly as possible, to offer a few observations in explanation of these Tables.

I. AMENDED TABLE OF ACREAGE.

On the 1st of September I had the honour of reporting to my Lords the acreage of the different crops and the amount of stock in each county, as tabulated from the returns made by occupants of land rented at and above £10 in twenty-six counties, and at and above £20 in eight counties. The arable acreage and stock belonging to the occupants of smaller tenements, as ascertained by a survey of their holdings in 1854, was also given.

It is unnecessary to reproduce the returns of stock* published in September, but I have considered it proper to repeat the Table for acreage, not only on account of some alterations to which it has been subjected; but because, without it, the calculations in Table III. might appear to be incorrect. The estimates of produce in that Table are obtained by multiplying the acreage of a crop with its average acreable produce in bushels or tons; consequently, the results contained in Table III. if tested by applying the figures in Table IV. as the multipliers of those in No. I., would seem to be erroneous wherever the latter have been altered since their first publication.

As an "*amended table*" is now submitted for the first time, it might be supposed, either that the acreage returns have not this year

* As the Stock Table has not previously appeared in the Transactions, it is now given as an appendix.

been made with the same accuracy as on former occasions, or that formerly they were not sifted with the same care as now. The explanation, however, is simple. In 1855, and previously, the returns of acreage were printed, along with the estimates of produce, in December or January; there was, therefore, ample opportunity between the period of their reception and that of their publication, to investigate all questions with reference to their accuracy. But the returns having this year been tabulated and printed as soon as obtained, I was under the necessity of assuming their accuracy, and of deferring inquiry. This may not be without its advantages, as a comparison between the original and the amended table affords the means of ascertaining the extent, and determining the character of the errors attaching to the first, and establishes, it is conceived, two points of importance: (1.) The immaterial character of the alterations, and the causes to which they are attributable, in no way affect the integrity of the returns, nor raise a reasonable doubt as to the good faith in which they have been made, but tend rather to confirm their general accuracy and trustworthiness. (2.) The alterations go far to meet the objections which have been urged as to the want of all test of accuracy in the machinery which is employed, and to prove that there are means and appliances for detecting and correcting error.

An examination of the amended return will show a decrease on the gross area in tillage of 530¾ acres, but a much greater difference in details. As compared with the table published in September, there is now an excess—in wheat, of 1485¾ acres; in barley, of 75½; and in oats of 386. These alterations are chiefly attributable to two clerical errors, by which a considerable acreage was overlooked in summation, and, though they could not escape the investigation to which the calculations are subjected, it was impossible to correct them in time, owing, as has been observed, to the early publication of the Tables this year. 133½ acres of rye-grass have been transferred from the column for rye to that for grass; vetches are less by 865 acres, misplaced, and properly belonging to the column for green-crops; while turnips are in excess 389¾ acres, and potatoes 420¾, principally through the erroneous entry of vetches, and the omission of acreage already mentioned. In addition to these causes, alterations have also been operated by returns having been amended, since September, by the parties who made them, or by Enumerators. The principal difference, however, is observed in column 18, and consists in the deletion of bare fallow, or its transference to grass under rotation. It was from the first apparent that, in some districts, the bare fallow returns were in excess, and the result of investigation has been to reduce the extent from 17,715 to 15,464½ acres, or nearly 13 per cent. This is accounted for, partly by a misapprehension of the meaning of the term, among some of the smaller farmers, in districts where bare fallow is unknown,

who scheduled, as such, acreage which should have been returned as grass under rotation; a considerable breadth of land, recently trenched and reclaimed from waste, but not yet cropped, was further scheduled as fallow; this, strictly, cannot yet be regarded as having come under a rotation of tillage, and should, therefore, have been omitted; at all events, as ground under reclamation, it indicates a much more progressive state of agricultural improvement, than a return of bare fallow would serve to convey. Notwithstanding the acreage which has been transferred from bare fallow to grass, the latter only shows an increase of 191¼; this, however, would have been considerably greater but for acreage removed from the grass column, which investigation showed was not under a rotation of tillage, but pertained to permanent pasture, not now embraced by the inquiry.

The difference between the original and amended Table may be summed up as follows:—

Decrease on Vetches,		865	acres.
„ Bare Fallow,		2250½	„
		3115½	„
Increase on White Crops,	1730		
„ Green „	663½		
„ Grass „	191¼		
		2584¾	„
Decrease, as above,		530¾	„

It has already been stated that returns of acreage, published on the 1st of September, cannot previously be passed through any ordeal of inquiry; the Report, therefore, must always then be accepted as of an interim character, subject to alterations rendered necessary by, and now submitted in consequence of, subsequent investigation.

Passing from discrepancies between the original and the amended tables of acreage, I may be permitted to offer a few remarks on the differences observable in the distribution of the crops of 1856 and 1855. A comparison between the two years exhibits uniformity as regards the gross results, with very considerable variations in detail, but precisely such as might have been looked for, and should be found.

In 1856 the area under tillage was,	3,545,191	acres;
In 1855,	3,530,068½	„
Showing an excess in 1856 of	15,122½	„

which is perfectly in accordance with the agricultural improvements known to be in operation, and with the inducements which high prices have held out to break up old pasture. As regards details, the most prominent difference between the two years is the increased area under wheat. Indeed, the rapid extension of that

crop, during the three years the statistical inquiry has been in operation, is remarkable, and, but for its operation, would comparatively have been unknown. In 1854 there were 168,216 acres of wheat; in 1855, 191,300¾; and in 1856, 263,328 acres,—an increase upon last year of 72,027¼ acres, and of 56½ per cent on the returns for 1854. The information afforded by the acreage table for the current year enables us to account for this great excess, not only consistently with the circumstances of the times, but satisfactorily as regards the progress of agriculture. The remunerative prices which have been obtained for wheat make it natural that it should be substituted, where practicable, for barley and oats, and lead us to look for the conversion of grass land into grain. We may, therefore, seek to find the increase in wheat met by a corresponding decrease in the acreage of the other white crops, and of grass under rotation; as it would argue ill for the state of agriculture did any proportion appear to be a subtraction from the area under green crops. We learn, accordingly, from Table I., that in 1856 the extent under barley had decreased

creased	20,343½ acres.
Oats, ...	15,018 „
Grass under rotation, . . .	34,268½ „
	69,630 „

thus, together, nearly accounting for the increase in wheat. I would guard myself, however, against its being inferred from this statement that wheat has directly replaced so large an extent of grass. To a certain extent, and in some districts, it has succeeded grass; but, in general, its substitution for barley and oats will account for the excess: indeed, the acreage of the latter crop would probably have shown a much greater decrease than is indicated, had it not been compensated by the grass land, which, according to the ordinary rules of husbandry in this country, was principally broken into oats.

The fact that the green crops, including beans and pease, exhibit an increase of 17,479¾ acres upon the breadth of 1855, is of importance, as showing that the farmers of the country are not attempting to increase the production of wheat, without, in some measure, properly and legitimately preparing for its extension.

Before closing this cursory view of the comparative distribution of crops in 1855 and 1856, I must advert to the great difference between the returns of bare fallow for the two years. In 1855 there were 22,462 acres; in 1856 there were 15,464½, showing a decrease of 6,997½ acres. It must not, however, be concluded that there is, by this extent, less land under preparation for wheat by means of fallow, as the greater proportion of the excess of 1855 was erroneously returned under the misapprehensions which have

already been referred to, and which, to a minor degree, have this year been again in operation.

II. Proportional Acreage.

This Table is presented for the first time, and, though not called for by my Lords, will, it is hoped, be regarded as an appropriate addition to that part of the Report bearing on the extent of land in tillage, and the distribution of the crops. It is stated at the per-centage which each crop, in a county, bears to the whole land under tillage, and its object is to indicate, without the necessity of making minute calculations, the relative proportions of the different crops. It will be observed that the Table is divided into three sections, consisting of—*1st*, The grain and other crops of an exhausting character; *2d*, The green crops and fallow, which are generally employed as restoratives; *3d*, The grass. The total per-centage of each of these sections is given in separate columns, and, by comparing them, a tolerable knowledge is obtained of the average rotation observed in each county. Thus, Ayrshire, a dairy district, has two parts in grain crops, one in green crops, and four in grass, indicating a rotation of seven years. Aberdeenshire has two parts in grain, one in green crop, and two in grass, giving a rotation of five years. Berwickshire shows rather more green crop and less grass than is proper to a five years' rotation, which is consistent with the existence occasionally in that county of a six years' shift, containing two green crops. It is unnecessary to multiply illustrations; the table is not offered as determining rotations either in these counties or elsewhere, varying, as cropping does, not only in different districts of the same county, but on different portions of the same farm,—still, the results may be interesting as indicative of an average.

III. Estimates of Gross Produce per County.

It has been observed in England "that we are living in an age of statistical imposture, and that many returns in reference to agriculture are made by men who are not acquainted with rural life." Whatever truth there may be in this statement elsewhere, it has, assuredly, no application to Scotland, as the estimated returns, now submitted, emanate from men selected on account, not only of their intimate "acquaintance with rural life," but of their integrity, skill, and experience, and their special knowledge of the agriculture of the localities within which they act. For the purposes of the statistical inquiry, Scotland is divided into 119 districts, containing a greater or lesser number of parishes, according to the geographical divisions and agricultural features of the country. Every district is under the supervision of an Enumerator, and he, himself a farmer, is aided by a committee, composed of influential

members of the same class, taken from each of the combined parishes, and whose duty it is to obtain the most reliable information regarding the results of the harvest in their own immediate neighbourhood. These committees are convened by their respective Enumerators between the 15th and 30th of November, when, on the data submitted to the meeting by each member, the average acreable produce of each crop grown within the district is estimated and reported to me, which enables me to strike similar averages for counties, and, by applying them to the acreage, to bring out the estimates of gross produce now under consideration. We have thus the services and assistance of more than a thousand practical Farmers, specially selected, from local and professional fitness, for the duty devolved on them, and openly assuming the responsibility of its faithful discharge.

In again presenting the results of their labours, I am entitled to claim for the estimates that respect and confidence which are due to the honesty of purpose, and careful consideration bestowed upon them by the different Enumerators and Committees. Their duty—at all times one of difficulty—has this year been encompassed by unusual obstacles, and, but for my cognisance of the anxiety and exertions with which these have been met, I should feel hesitation in laying the estimates before my Lords; as it is, they must be accepted with more than usual caution, and read with a greater than ordinary allowance.

In many districts of Scotland, especially along the east coast, and in some of the midland counties, the past harvest has been of a most exceptional and anomalous character. The grain crops, though late, generally promised well, and a portion had been secured in good condition, but the greater part was in stook, or uncut, when, towards the close of September, it was exposed to a violent storm of wind and rain from the east, lasting for several days, and succeeded by weeks of weather unsuitable for, and suspending all harvest operations. The results were disastrous in various ways: grain on the field was shaken, sprouted, and discoloured; while much in the stackyard heated, owing to the unfavourable circumstances in which it was secured; in short, the difficulties encountered in securing the crops were greater than have been experienced since 1816. Fortunately this state of matters did not extend over the whole country; the western counties comparatively escaped, and, at a time when the crofters on the outskirts of the Argyllshire coast had their little stackyards completed, the great farmers of Berwickshire, the Lothians, Fife, Forfar, and other highly cultivated districts, had the bulk of their crops unsecured. It must be obvious how greatly the difficulties, always attached to an estimate of produce, have this year been enhanced: not only has much actually been lost, but the unusual proportion of light grain, the

varieties in quality, and above all, the still unascertained damage which may have been progressing in the stack, combine to invest the estimates for 1856 with such exceptional features, that I could not permit them to go forth unattended by the foregoing explanation. I have only to repeat that those intrusted with the duty of preparing them have done their best to overcome, by increased care and caution, the unfavourable circumstances I have endeavoured to describe.

Tables IV. and V.

The foregoing observations equally apply to Table IV., the estimate of average acreable produce per county, and to Table V., the estimate of average acreable produce per district. I have already explained that the latter emanates directly from the various committees, and forms the foundation of Nos. III. and IV. which are worked out in my office. The only special remark called for in regard to this table is, that the estimate of potatoes refers merely to the sound part of the crop; for information regarding the proportion diseased, reference is made to the special reports in No. VII.

VI. Table of Weights.

Subsequently to the issue of the principal Report last year, certain information, with reference to the weight of the cereals, was published as a supplement, and, according to the instructions of my Lords, I have now endeavoured to obtain such information more systematically, and to tabulate the results. It must be evident that this is an unfortunate year for a first attempt of the kind, in consequence of the unusual proportion of light grain, and the great varieties of quality in many districts. In those counties where the harvest was so unfavourable, the Enumerators have estimated weight with considerable hesitation—in some instances indeed, as the corresponding blanks in the table will show, they have found it impossible to make a report, and in others, (marked by an asterisk *), they only estimate the weight of that portion of the crop which was secured in good condition before the bad weather. Generally the figures indicate either the points between which weights are supposed to range, or what is conceived to be the average between these. I have no doubt, now that the attention of the Committees has been formally turned to the weight of grain, that we shall in future, and with seasons less exceptional in their character than the past, succeed in obtaining the information sought for, in a shape more satisfactory than that now presented.

VII. List of Districts, and Reports by Enumerators.

The Reports, appended to the List of Districts, are presented for the first time; I was induced to call for them in consequence

of the peculiar character of the harvest, but they may not be considered necessary under circumstances less exceptional than those which it has been my duty to explain. With the view of obtaining as much information as possible regarding the effects of exposure and unfavourable weather, I addressed, in the month of October, the following circular to each Enumerator:—

"As in many districts the backward state of the weather has materially retarded the carrying of the crops, it has been suggested that Enumerators should report, as nearly as possible, the proportion of grain in their respective districts secured early, and how far the quality of what has been outstanding beyond the usual period is deteriorated. You will oblige me by calling the attention of your committee to these points."

The Abstracts now submitted contain the replies by the Enumerators, condensed and arranged as systematically as I could. Many of these communications were elaborate and valuable, but their insertion at length would be inconsistent with the limits of this Report; while, perhaps, the comparative results in different districts might not have been so easily arrived at, as under the arrangement adopted. I need scarcely remark that the additional information afforded by these Reports has entailed no small amount of extra labour on the Enumerators and their Committees, and affords a renewed proof of the zeal with which their duties are performed.

In conclusion, it is my pleasing duty to inform my Lords that the returns continue to be freely and voluntarily made by the agricultural community. Instances there are, no doubt, of opponents, who plead the objections so frequently heard in England, but such cases are singular. The farmers of Scotland have practically satisfied themselves that the inquiry is in no respect inquisitorial, and that it cannot possibly divulge or compromise individual interests. They appreciate with intelligence the importance of statistical information, and they would rejoice could the inquiry be systematically extended over the three countries, believing that its results are comparatively valueless, so long as its operation is partial.

I have the honour to be, &c.

(Signed) JN. HALL MAXWELL.

JAMES BOOTH, Esq.
Principal Secretary of the Board of Trade.

TABLE I.

Table No. I.—Acreage.

Counties	Number of Occupants	Total Acreage under a Rotation of Crops 1856	Total Acreage 1855	Wheat 1856	Wheat 1855	Barley 1856	Barley 1855	Oats 1856	Oats 1855	Rye 1856	Rye 1855
1. Aberdeen	7,380	486,073½	479,058¾	15,262	5,409¾	7,421½	7,109	163,906½	170,087¼	290½	225¼
2. *Argyll	1,594	71,205	80,953¼	685½	427¾	1,197¾	1,240¼	23,213	22,892½	345	374¾
3. Ayr	3,329	263,248½	258,154¾	16,879¼	12,847½	698¼	682¾	60,740¾	61,648¼	535½	361½
4. Banff	1,721	113,527¼	111,214½	2,346¼	1,173¼	3,879¾	3,649¼	41,289½	41,404¾	33¼	38¾
5. Berwick	740	147,301¾	146,944	14,316¼	9,982¾	12,738	15,119½	31,325¾	31,793¼	98	54½
6. Bute	136	11,830¼	12,064¼	1,185¼	832¾	141¾	154¾	2,445¾	2,680¾	4¾	5½
6. *Arran	149	6,250¼	6,086	211¾	184¾	12¼	17¾	1,635¼	1,661¼	22¼	30¾
7. *Caithness	523	50,324¼	47,854½	617¾	168	243	243½	19,258¾	18,288¼	21¾	6¼
8. Clackmannan	224	18,131½	19,079	2,846½	2,225½	1,624¼	1,780¾	3,518	3,971¾	—	½
9. Dumbarton	616	41,492	42,256¾	2,543¾	2,099½	946¼	957	10,013½	9,904¼	—	28
10. Dumfries	1,970	173,394¼	174,363½	4,176¼	3,244	2,756¾	2,578	50,795½	50,499¼	94¼	118¼
11. Edinburgh	888	104,077¾	102,604½	11,628	9,113¼	10,123¼	10,297½	23,181¾	23,488¾	8¼	¼
12. Elgin	1,146	80,413½	79,853¼	8,657¾	7,298¾	8,642½	8,508	16,938¾	17,974¼	676¼	471¾
13. Fife	1,933	221,515¾	218,534¾	34,099½	26,952¾	22,817¼	25,934	42,327¾	44,137¾	678¾	618½
14. Forfar	2,130	220,705	215,270½	25,469½	16,232½	18,018¼	23,135¾	49,927¾	50,896	109¾	134¼
15. Haddington	457	100,435¼	101,528¾	19,226	17,472½	10,147¾	10,856	15,659¼	16,692¾	20	32½
16. *Inverness	741	42,753	42,030¼	2,220¼	1,539½	2,098	2,220¾	13,962	13,704¾	256	125
17. Kincardine	1,392	100,889½	101,458¼	6,080	2,767½	7,079	7,598¼	28,165	29,785¾	195¾	173½
18. Kinross	304	33,783¼	33,132¼	1,770¾	909½	2,474	2,867½	7,659	8,030½	4½	9¼
19. Kirkcudbright	1,408	120,817¾	124,821¾	2,441½	1,715¼	1,464¾	1,382¼	33,762	33,858¼	58¾	40
20. Lanark	2,992	209,541½	206,405¼	8,978¾	7,582	1,787¼	2,037¾	54,803¾	54,738	56¼	68
21. Linlithgow	458	52,511¼	52,788¾	4,643½	3,792	3,789¾	4,057¼	12,520	12,339	2	3¼
22. Nairn	434	29,664	29,553	2,316¼	1,714½	2,706½	3,043½	7,385¼	7,752¾	314½	255
23. *Orkney	278	25,572¾	23,989¾	40	15	106¾	82¾	8,633½	7,962¾	48¼	11½
23. *Zetland	41	1,170	1,206¼	1	—	3½	18¼	389	380¼	—	—
24. Peebles	306	36,510½	36,436¼	213¾	104¾	2,121½	2,027	10,458¼	9,910¼	¾	1
25. Perth	3,674	264,790¼	260,829¼	29,513¾	22,201¾	15,797¾	19,318¼	63,242	63,051¼	127	113
26. Renfrew	1,219	76,598¾	75,213	5,211¾	4,495¼	343¾	428¼	16,504	16,392	8	12
27. *Ross & Cromarty	861	72,204½	70,513½	11,908½	8,962¼	4,701¾	6,182¾	15,272	16,132¼	139¼	149½
28. Roxburgh	992	126,113½	134,781	10,148	7,133¼	10,398¼	12,462¾	28,190½	29,198¼	113	38¼
29. Selkirk	167	11,718	11,134¼	229½	116½	683¼	677	3,324¼	2,963½	—	—
30. Stirling	1,440	93,854¾	91,400	5,911¾	4,985½	6,444¼	6,773	22,654	22,378¾	33½	25½
31. *Sutherland	140	9,916½	10,674¼	544¾	258	936½	1,051¾	2,336¾	2,461	49¾	16½
32. Wigtown	1,130	126,855¾	127,880¾	11,003¼	7,343	1,392¾	1,589¼	33,205¾	34,602¼	275½	150
	42,913	3,545,191	3,530,068½	263,328	191,300¾	165,738¾	186,082¼	918,644½	933,662½	4,620¾	3,692

Counties	Bere 1856	Bere 1855	Beans 1856	Beans 1855	Pease 1856	Pease 1855	Vetches or Tares 1856	Vetches or Tares 1855	Turnips 1856	Turnips 1855	Potatoes 1856	Potatoes 1855
1. Aberdeen	4,194	4,741½	452¾	324¾	329½	289¼	1,957	1,021	81,373	79,612¾	7,354¼	7,498
2. *Argyll	1,536¾	1,814¾	601¾	636½	117½	94	131¾	150½	6,337¾	6,346¼	5,883¾	5,178¾
3. Ayr	293½	288¼	3,679½	3,485¼	36	34¾	422½	420	16,464¾	16,480¾	8,688½	8,166½
4. Banff	515	730½	233½	167¾	82¼	80¾	584¾	357½	18,121½	17,412½	2,142	2,159¼
5. Berwick	56	57	1,829	1,613½	513¾	670¾	981½	880¼	27,070¾	26,980¾	2,151¾	2,104
6. Bute	—	—	5¼	11	¾	¼	26¼	25	1,165	1,188	664¼	625½
6. *Arran	118¾	133¾	123¼	118½	32	40½	2¼	3¼	442¾	421¼	401	342¼
7. *Caithness	1,740¼	1,683½	—	—	31½	—	323½	252½	7,839¼	7,326	1,282½	1,442¼
8. Clackmannan	—	6¼	1,525¼	1,532½	—	—	181¼	143½	1,861½	1,832¾	444¼	382¼
9. Dumbarton	27¼	27¼	712¾	715	11¼	14	212	164¾	2,449¼	2,567	2,727½	2,378
10. Dumfries	43¾	34	742	512¾	37¾	26	162¾	184¼	21,019	20,684½	6,372¾	6,300½
11. Edinburgh	99¼	162¾	1,576½	1,426¾	181½	144¼	1,263¾	1,135¼	14,517¼	13,862¼	6,668½	6,749¾
12. Elgin	410¼	494½	97¼	84¾	240½	224¾	375½	240	12,263	11,967¾	3,563¾	3,717
13. Fife	38½	34½	3,602¾	3,441	456	621	1,593	1,491¼	29,739¼	28,991¼	17,269	17,355
14. Forfar	287½	337	852¼	516½	186¼	271	1,408½	938¼	33,486¼	32,518¼	14,503	14,258½
15. Haddington	31½	44	4,219	3,930¾	184½	170¼	997¼	1,058¾	16,378½	16,063½	6,082½	6,451½
16. *Inverness	856½	1,034¼	44¾	67¼	159¼	162½	271¼	186¾	5,448¾	5,286¾	3,062¼	2,916½
17. Kincardine	459¼	678¼	586½	460¾	36½	50	395½	228¼	16,853¼	16,690	2,893½	2,937
18. Kinross	13½	1	116	134	35	24	247¼	230	4,346½	4,270½	1,053¾	1,053¾
19. Kirkcudbright	55½	19	503	395	2	4¼	84½	63	15,146¼	14,535	3,107	2,965¾
20. Lanark	299¾	369¼	4,010¼	3,844¾	317¼	362	1,688½	1,670½	11,443	11,341½	8,733¼	8,202¼
21. Linlithgow	51¾	8	1,776¾	1,657¾	2¾	52¾	509½	416½	5,142	4,983¾	2,044	1,925¼
22. Nairn	77¼	87	12¼	16½	114¾	100¾	143	70½	4,659½	4,467	1,524¼	1,542
23. *Orkney	2,797	2,931¼	1½	5	8	7½	76	34½	3,428	3,016¾	1,159¼	1,301
23. *Zetland	83¾	70	¼	—	—	—	2	¼	121¾	111¾	90¾	75¼
24. Peebles	13½	27¼	21	19¼	172	182¾	250¼	227	5,356¼	5,265¾	863¼	956
25. Perth	591½	773¾	4,146¼	3,603¾	388¼	573¾	1,256	919	32,185¼	31,351½	17,649¼	18,171½
26. Renfrew	70¾	84½	1,492¼	1,585¼	7	10¾	194¼	192¾	3,134½	3,334	5,935¼	5,534½
27. *Ross & Cromarty	224	220¾	384¾	362½	486¾	515¼	904½	840	12,106	11,387¼	4,639½	4,501½
28. Roxburgh	16½	10½	1,070½	762¾	565¼	588¾	620	574¼	24,016½	24,080¾	1,772¼	1,760½
29. Selkirk	3¾	7	23½	½	19½	32	59¾	49	2,065¼	1,940	216	190¼
30. Stirling	30½	18	4,967¾	4,776¾	11½	11¼	645¾	616	6,197½	5,963½	3,904½	3,607
31. *Sutherland	118	97¼	12	¾	17	13½	43¼	71	1,747½	1,833¾	371½	371¼
32. Wigtown	228¾	237½	1,048¾	1,098¾	34	82¾	216½	183½	16,204½	15,289½	4,132½	3,843½
	15,383½	17,263½	40,470¾	37,308½	4,817¼	5,456	18,231¼	15,038¾	460,131	449,404½	149,351	146,969¾

Counties	Mangold 1856	Mangold 1855	Carrots 1856	Carrots 1855	Cabbage 1856	Cabbage 1855	Rape 1856	Rape 1855	Flax 1856	Flax 1855	Turnip Seed 1856	Turnip Seed 1855	Any other Grain or Root Crop 1856	Any other Grain or Root Crop 1855	Bare or Summer Fallow 1856	Bare or Summer Fallow 1855	Grass and Hay under Rotation 1856	Grass and Hay under Rotation 1855	Counties
1. Aberdeen	28¼	16½	57½	70½	127	98¾	16½	—	384	510	298½	234	98	121	854¾	1,024	201,668½	200,665¾	Aberdeen . 1
2. *Argyll	64¼	33¼	35¼	17¼	49¾	27½	10¾	—	12¾	14½	36¾	38¾	26	19½	110	1,343	30,809	40,303½	Argyll . 2
3. Ayr	1,207	828½	410¼	307¼	339¾	263¾	40¾	—	17¼	69	66¼	46½	39	63½	469½	944¼	152,220¼	151,216½	Ayr . 3
4. Banff	9¾	9¾	2¼	5	19¾	14¾	1¼	—	60¾	58½	81¾	92½	27¼	11½	169¾	426½	43,927	43,422	Banff . 4
5. Berwick	155¾	57½	17	14½	15½	11½	270	—	—	2	94½	171½	35¾	153½	1,400½	1,574½	54,232	55,702¾	Berwick . 5
6. Bute	8¾	4¾	1	½	2¼	5	—	—	—	—	17¼	4	7½	—	—	55½	6,154½	6,471	Bute } 6
6. *Arran	19¾	10¾	1¾	4	11	4¾	—	—	½	—	—	5½	¾	—	6½	105¼	3,208½	3,002¼	Arran } 6
7. *Caithness	1½	—	¼	¼	16½	9½	7¼	—	10½	31	19½	14¾	9	1½	188¾	310¾	18,713¼	18,076¾	Caithness . 7
8. Clackmannan	8	18¼	12½	8	2	4	½	—	—	¼	18	½	1¾	—	270¾	334	5,817	6,838¼	Clackmannan . 8
9. Dumbarton	43¼	37¾	5	6¼	34¾	35¼	—	—	352¾	432½	4½	16	—	7½	166	330¼	21,242	22,536½	Dumbarton . 9
10. Dumfries	116¾	40½	49¾	45¼	35	24¼	562¼	—	12¼	¼	59¼	70¾	15½	353	317	655	86,026	88,992½	Dumfries . 10
11. Edinburgh	124¾	96	91¾	38	76¼	75	33	—	3¼	¾	182	187	118¼	81¼	497¼	441¾	33,703	[illegible]	Edinburgh . 11
12. Elgin	21¾	7¾	4¾	2½	30¾	24¼	16¼	—	½	1	34½	53	4	12	256¾	251½	28,178¾	28,519¾	Elgin . 12
13. Fife	95¾	103½	48¾	33¼	24¾	9¾	4	—	576½	428¼	81	56¼	16	58¼	2,149	2,451½	65,898	65,817	Fife . 13
14. Forfar	17½	9¼	35	26½	21½	15¼	30	—	17¾	5¾	26¼	46¾	25	39½	237¾	376½	76,045¼	75,513	Forfar . 14
15. Haddington	167	114	109	122¾	36¾	25	27	—	—	—	221¼	298¾	3½	51¼	981¼	1,257	25,943¼	26,887½	Haddington . 15
16. *Inverness	15¼	16½	5	[illegible]	30¾	25½	—	—	1	3	13	4	4¼	2¼	289¼	506¾	14,015½	14,226½	Inverness . 16
17. Kincardine	6¼	6	33¾	28	14	9	—	—	2½	76	56½	44	2	18	114¾	323½	37,915½	39,584½	Kincardine . 17
18. Kinross	2	1¼	7	2¾	11¾	7¼	—	—	15¾	28	44¼	16½	—	¼	168¾	113	15,813½	15,433¾	Kinross . 18
19. Kirkcudbright	100¾	58¼	46½	31¾	10	6	153¾	—	9½	¾	26¾	37¾	—	15½	239	294	63,606¼	69,399¾	Kirkcudbright . 19
20. Lanark	114½	80	46½	39¾	251	275	2	—	540½	746¼	61¼	11¾	132¼	44¼	1,073¼	1,515½	115,202	113,476¾	Lanark . 20
21. Linlithgow	45½	28¾	13	10¾	12¾	10¼	—	—	105¼	169¼	59	70¼	53½	—	340	520¾	21,400¼	22,743¼	Linlithgow . 21
22. Nairn	9	5¾	1¼	—	6½	3¾	—	—	—	—	12¾	8	—	—	102	165¼	10,279¼	10,320¾	Nairn . 22
23. *Orkney	58½	1¾	6¼	4	38	34¼	6	—	—	¼	22¼	46	6¼	6	308	232	8,829½	8,297½	Orkney } 23
23. *Zetland	—	—	—	¾	7¾	6¾	½	—	—	—	—	—	—	—	11¼	7	458½	535¾	Zetland } 23
24. Peebles	3½	4½	6½	1½	2½	1	30	—	—	—	1½	5¾	—	3	13¾	83¾	16,982¼	17,615¾	Peebles . 24
25. Perth	42¼	19¼	27½	17¼	29¼	33¾	—	—	31¾	65½	58¾	191½	23¼	7¾	1,430½	2,359½	98,250¼	98,057¼	Perth . 25
26. Renfrew	154	120½	25¾	20¼	96¾	49½	—	—	16¼	43¾	8¼	11½	8½	32¼	262¼	302½	43,125½	42,563½	Renfrew . 26
27. *Ross & Cromarty	21¼	14¾	1¾	1¼	13	4	5	—	2¾	½	24½	37½	90	6	491¼	704	20,788¼	20,491½	Ross & Cromarty 27
28. Roxburgh	39½	19¼	11¼	5	7¾	13¼	148½	—	—	—	37½	81	20¼	90½	515¼	741½	48,422½	57,220½	Roxburgh . 28
29. Selkirk	—	—	¼	—	1½	¼	3	—	—	1	—	½	—	—	75	102¾	5,013¼	5,048	Selkirk . 29
30. Stirling	35¾	14½	14½	9¾	44	35¾	3¾	—	548¾	770½	6¾	38¼	26	—	1,401½	1,720½	40,972¾	39,655½	Stirling . 30
31. *Sutherland	—	—	¼	3¾	1½	2	—	—	—	1	3	3½	1¼	—	21	43	3,712¼	4,446¼	Sutherland . 31
32. Wigtown	793¼	520¾	403¾	310¾	63	44½	35	—	½	1¾	82	54½	1¼	24½	532¼	845½	57,202½	61,658½	Wigtown . 32
	3,531	2,299½	1,532¾	1,191	1,485	1,209¾	1,407	—	2,723¼	3,461¼	1,759¼	1,998¾	795¾	1,223½	15,464½	22,462	1,475,775¾	1,510,044¼	

* In the Counties marked with an asterisk, there are no returns from occupants whose rent is below £20; in the other Counties, all at and above a rent of £10 are included.

Note.—The arable acreage occupied by small tenants not included in the returns was, in 1854, returned at 230,170 acres, and forms an addition to the column for total acreage.

COUNTIES.	WHITE CROPS, &c.						
	Wheat.	Barley.	Oats.	Rye and Bere.	Flax.	Vetches, Turnip-seed, & any other Crop.	Total percentage of White Crops.
1. Aberdeen	3·140	1·527	33·720	·923	·079	·484	39·873
2. Argyll	·963	1·682	32·601	2·643	·018	·273	38·180
3. Ayr	6·412	·265	23·074	·315	·007	·200	30·273
4. Banff	2·067	3·415	36·370	·483	·054	·611	43·000
5. Berwick	9·719	8·648	21·267	·104	—	·755	40·493
6. { Bute	10·019	1·198	20·674	·040	—	·431	32·362
6. { Arran	3·388	·196	26·163	2·256	·008	·048	32·059
7. Caithness	1·228	·483	38·269	3·501	·021	·699	44·201
8. Clackmannan	15·698	8·959	19·403	—	—	1·108	45·168
9. Dumbarton	6·131	2·281	24·133	·066	·850	·522	33·983
10. Dumfries	2·409	1·590	29·294	·080	·007	·137	33·517
11. Edinburgh	11·172	9·727	22·273	·103	·003	1·503	44·781
12. Elgin	10·767	10·748	21·064	1·351	·001	·515	44·446
13. Fife	15·394	10·300	19·109	·324	·260	·763	46·150
14. Forfar	11·540	8·164	22·622	·180	·008	·661	43·175
15. Haddington	19·143	10·104	15·591	·051	—	1·217	46·106
16. Inverness	5·193	4·907	32·657	2·602	·002	·675	46·036
17. Kincardine	6·026	7·017	27·917	·649	·002	·450	42·061
18. Kinross	5·242	7·323	22·671	·053	·047	·863	36·199
19. Kirkcudbright	2·021	1·212	27·945	·095	·008	·092	31·373
20. Lanark	4·285	·853	26·154	·170	·258	·898	32·618
21. Linlithgow	8·843	7·217	23·842	·102	·200	1·184	41·388
22. Nairn	7·808	9·124	24·896	1·320	—	·525	43·673
23. { Orkney	·157	·418	33·760	11·126	—	·409	45·870
23. { Zetland	·086	·299	33·248	7·158	—	·171	40·962
24. Peebles	·585	5·811	28·645	·039	—	·689	35·769
25. Perth	11·146	5·966	23·885	·271	·012	·505	41·785
26. Renfrew	6·804	·449	21·547	·103	·021	·275	29·199
27. Ross & Cromarty	16·493	6·512	21·151	·503	·004	1·411	46·074
28. Roxburgh	8·047	8·245	22·353	·103	—	·538	39·286
29. Selkirk	1·959	5·831	28·368	·032	—	·510	36·700
30. Stirling	6·299	6·866	24·138	·068	·585	·723	38·679
31. Sutherland	5·493	9·444	23·565	1·692	—	·479	40·673
32. Wigtown	8·674	1·098	26·176	·397	—	·236	36·581
Proportional Acreage of the Crops in 1856	7·428	4·675	25·912	·564	·077	·586	39·242
Do. do. 1855	5·419	5·271	26·449	·594	·098	·517	38·348
Do. do. 1854	4·765	5·879	26·430	·621	·189	·421	38·305

REAGE OF THE CROPS IN EACH COUNTY.

GREEN CROPS AND FALLOW.							GRASS.	COUNTIES.	
Beans and Pease.	Turnips.	Potatoes.	Mangold.	Carrots, Cabbage, and Rape.	Bare or Summer Fallow.	Total percentage of green crops and fallow.	Grass and Hay under Rotation.		
·161	16·741	1·513	·006	·041	·176	18·638	41·489	Aberdeen .	1.
1·010	8·901	8·263	·090	·134	·154	18·552	43·268	Argyll . .	2.
1·411	6·254	3·301	·459	·300	·178	11·903	57·824	Ayr . . .	3.
·278	15·962	1·887	·009	·021	·150	18·307	38·693	Banff . .	4.
1·590	18·379	1·461	·105	·205	·950	22·690	36·817	Berwick . .	5.
·051	9·848	5·615	·073	·027	—	15·614	52·024	Bute . .	6.
2·484	7·083	6·415	·316	·204	·104	16·606	51·335	Arran . .	
·062	15·577	2·548	·003	·048	·375	18·613	37·186	Caithness .	7.
8·412	10·267	2·450	·044	·083	1·493	22·749	32·083	Clackmannan .	8.
1·745	5·903	6·574	·104	·096	·400	14·822	51·195	Dumbarton .	9.
·449	12·122	3·675	·067	·373	·183	16·869	49·614	Dumfries .	10.
1·689	13·949	6·407	·120	·193	·478	22·836	32·383	Edinburgh .	11.
·420	15·250	4·432	·027	·064	·319	20·512	35·042	Elgin . .	12.
1·832	13·425	7·796	·043	·035	·970	24·101	29·749	Fife . . .	13.
·471	15·172	6·571	·008	·039	·108	22·369	34·456	Forfar . .	14.
4·384	16·308	6·056	·166	·172	·977	28·063	25·831	Haddington .	15.
·477	12·745	7·163	·036	·084	·677	21·182	32·782	Inverness .	16.
·618	16·705	2·868	·006	·047	·114	20·358	37·581	Kincardine .	17.
·447	12·866	3·119	·006	·055	·499	16·992	46·809	Kinross . .	18.
·418	12·536	2·572	·083	·174	·198	15·981	52·646	Kirkcudbright	19.
2·065	5·461	4·168	·055	·143	·512	12·404	54·978	Lanark . .	20.
3·389	9·792	3·893	·087	·049	·648	17·858	40·754	Linlithgow .	21.
·428	15·708	5·138	·031	·026	·344	21·675	34·652	Nairn . .	22.
·037	13·404	4·533	·229	·196	1·205	19·604	34·526	Orkney . .	23.
·021	10·406	7·756	—	·705	·962	19·850	39·188	Zetland . .	
·528	14·671	2·364	·010	·107	·038	17·718	46·513	Peebles . .	24.
1·713	12·155	6·665	·016	·021	·540	21·110	37·105	Perth . .	25.
1·957	4·092	7·748	·201	·160	·342	14·500	56·301	Renfrew . .	26.
1·207	16·767	6·425	·029	·027	·680	25·135	28·791	Ross & Cromarty	27.
1·297	19·044	1·405	·031	·133	·408	22·318	38·396	Roxburgh .	28.
·367	17·625	1·843	—	·043	·640	20·518	42·782	Selkirk . .	29.
5·305	6·603	4·160	·038	·066	1·493	17·665	43·656	Stirling . .	30.
·292	17·623	3·746	—	·018	·212	21·891	37·436	Sutherland .	31.
·854	12·774	3·257	·625	·396	·420	18·326	45·093	Wigtown .	32.
1·277	12·979	4·213	·100	·125	·436	19·130	41·628	1856	
1·212	12·731	4·163	·064	·068	·637	18·875	42·777	1855	
1·243	12·292	4·052	·055	·074	·740	18·456	43·239	1854	

TABLE No. III.—Estimate of Gross Produce per County.

Counties.	Wheat. 1856. Bushels.	Wheat. 1855. Bushels.	Barley. 1856. Bushels.	Barley. 1855. Bushels.	Oats. 1856. Bushels.	Oats. 1855. Bushels.	Bere. 1856. Bushels.	Bere. 1855. Bushels.	Beans and Pease. 1856. Bushels.	Beans and Pease. 1855. Bushels.	Turnips. 1856. Tons.	Turnips. 1855. Tons.	Potatoes. 1856. Tons.	Potatoes. 1855. Tons.
1. Aberdeen,	417,797	149,106	249,076	230,154	5,388,426	5,347,118	145,217	160,314	21,209	18,266	1,271,453	1,232,007	30,520	42,926
2. Argyll,	20,951	13,394	42,820	46,819	795,045	705,375	49,848	59,093	18,700	21,641	71,775	103,444	10,885	26,412
3. Ayr,	430,421	333,232	22,606	23,342	2,475,186	2,369,605	10,621	10,557	89,869	97,460	155,592	273,168	19,332	34,503
4. Banff,	67,895	31,531	133,366	128,864	1,354,812	1,273,196	15,740	22,546	8,999	7,952	250,983	248,781	7,497	11,174
5. Berwick,	408,908	274,526	418,762	488,549	1,135,558	1,134,622	1,680	2,063	66,622	61,246	422,980	346,703	8,822	16,201
6. { Bute,	32,965	25,399	4,270	5,890	89,270	88,297	—	—	171	266	12,524	18,518	1,395	3,432
{ Arran,	5,373	4,688	427	619	46,605	42,154	3,770	4,665	3,454	3,528	2,811	4,344	481	1,493
7. Caithness,	17,953	5,607	8,110	7,609	652,390	613,799	59,168	56,292	594	—	148,162	120,787	5,659	5,931
8. Clackmannan,	86,099	62,314	56,451	56,984	134,563	133,054	—	200	46,520	44,826	27,364	31,248	911	1,701
9. Dumbarton,	77,902	57,722	30,111	30,624	359,234	341,697	840	654	18,733	19,683	26,329	45,564	9,955	13,673
10. Dumfries,	106,233	71,379	82,702	76,051	1,657,203	1,480,259	1,222	903	22,467	16,028	283,757	294,237	20,711	29,612
11. Edinburgh,	332,125	273,967	356,221	376,502	821,503	830,915	3,226	6,968	59,442	47,915	204,875	204,988	15,921	39,739
12. Elgin	259,732	175,170	308,969	280,764	584,387	507,773	12,307	13,104	9,457	7,273	183,945	146,007	11,582	18,585
13. Fife,	914,293	680,557	748,699	873,652	1,579,354	1,475,856	1,270	1,201	123,031	112,467	390,328	434,869	41,661	78,965
14. Forfar,	721,105	434,219	623,882	721,546	1,940,941	1,676,387	8,697	10,047	34,790	21,902	481,365	415,421	34,988	66,302
15. Haddington,	541,933	491,414	404,642	443,060	680,199	764,737	1,197	1,675	125,775	122,261	239,740	245,370	17,715	43,306
16. Inverness,	62,167	37,814	59,400	64,957	387,445	363,176	19,699	21,206	4,654	5,227	72,060	73,948	6,048	12,176
17. Kincardine,	194,180	84,409	260,153	250,742	1,130,121	990,376	16,648	22,043	22,428	16,855	278,500	267,040	8,825	16,888
18. Kinross,	50,577	26,603	72,055	86,017	240,780	252,961	393	30	3,775	3,594	48,355	57,652	3,464	4,215
19. Kirkcudbright,	59,817	42,774	45,133	41,561	1,097,265	1,007,283	1,589	470	16,192	11,054	218,106	229,108	8,117	13,605
20. Lanark,	292,932	214,665	59,538	70,302	1,870,178	1,737,931	9,948	11,631	125,768	122,259	116,576	158,072	26,964	42,754
21. Linlithgow,	132,340	112,812	127,904	138,961	384,990	379,424	1,009	270	49,826	48,322	64,789	68,776	5,314	9,915
22. Nairn,	66,013	42,862	94,051	98,914	232,635	199,633	2,511	2,697	2,984	2,814	64,767	49,137	4,573	5,937
23. { Orkney,	1,107	393	3,303	2,746	247,673	258,789	94,049	105,525	190	—	58,105	42,536	6,376	6,261
{ Zetland,	—	—	—	—	11,670	—	2,512	—	—	—	1,826	—	136	—
24. Peebles,	6,105	2,822	66,032	62,330	300,675	338,931	256	1,037	3,100	2,841	66,953	70,956	2,590	4,505
25. Perth,	737,844	560,594	462,084	536,081	2,094,891	1,765,435	17,553	22,487	122,715	104,437	400,706	392,678	45,006	81,999
26. Renfrew,	160,261	112,943	11,773	15,042	584,860	553,230	1,857	2,477	39,824	46,583	32,520	51,594	19,586	33,207
27. Ross & Crom.,	344,602	233,018	167,206	204,417	577,472	493,042	6,888	6,167	23,585	21,834	187,643	163,834	12,990	20,876
28. Roxburgh,	278,436	183,235	358,098	396,471	1,064,191	1,027,413	467	336	48,766	37,420	404,678	309,438	4,054	9,331
29. Selkirk,	7,057	3,670	22,547	23,018	111,362	112,613	118	238	935	569	36,968	31,525	535	1,168
30. Stirling,	167,746	137,413	205,008	218,006	740,503	693,741	970	599	135,373	126,882	69,180	81,700	11,274	18,035
31. Sutherland,	19,134	8,885	33,831	35,759	86,752	80,136	3,474	2,693	564	114	28,222	29,707	1,221	1,633
32. Wigtown,	248,949	173,937	42,740	56,617	1,108,242	1,042,393	6,362	6,769	28,828	30,128	216,330	218,831	8,782	15,710
	7,270,952	5,063,074	5,581,970	6,092,970	31,966,381	30,081,351	501,106	556,957	1,279,440	1,183,647	6,540,267	6,461,988	413,890	732,170

TABLE No. IV.—Estimate of Average Acreable Produce per County.

Counties.	Wheat.		Barley.		Oats.		Bere.		Beans and Pease.		Turnips.		Potatoes.	
	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.
	Bu. Pk.	Bu. Pk.	Bu. Pk.	Bu. Pk.	Bu. Pk.	Bu. Pk.	Bu. Pk.	Bu. Pk.	Bu. Pk.	Bu. Pk.	Tn. Ct.	Tn. Ct.	Tn. Ct.	Tn. Ct.
1. Aberdeen,	27 1½	27 2¼	33 2¼	32 1½	32 3½	31 1¾	34 0¼	33 3¼	27 1	29 3	15 12½	15 9½	4 3	5 14½
2. Argyll,	30 2¼	31 1¼	35 3	37 3	34 1	30 3¼	32 1¾	32 2¼	26 0	29 2½	11 6½	16 6	1 17	5 2
3. Ayr,	25 2	25 3¾	32 1½	34 0¾	40 3	38 1¾	36 0¾	36 2½	24 0¾	27 2¾	9 9	16 11½	2 4½	4 4½
4. Banff,	28 3¾	26 3½	34 1½	35 1¼	32 3¼	30 3	30 2¼	30 3½	28 2	32 0	13 17	14 5¾	3 10	5 3½
5. Berwick,	28 2¼	27 2	32 3½	32 1¼	36 1	35 2¾	30 0	36 0¾	28 1¾	26 3¼	15 12½	12 17	4 2	7 14
6. { Bute,	27 3¼	30 2	30 0½	38 0¼	36 2	32 3¾	—	—	28 2	23 2½	10 15	15 11¾	2 2	5 9¾
Arran,	25 1½	25 1½	34 3½	34 3½	28 2	25 1½	31 3	34 3½	22 1	22 0¾	6 7	10 6¼	1 4	4 7¼
7. Caithness,	29 0¼	33 1½	33 1½	31 1	33 3½	33 2¼	34 0	33 1¾	—	—	18 18	16 9¾	4 8¼	4 2¼
8. Clackmannan,	30 1	28 0	34 3	32 0	38 1	33 2	—	32 0	30 2	29 1	14 14	17 1	2 1	4 9
9. Dumbarton,	30 2½	27 2	31 3¼	32 0	35 3½	34 2	30 3¼	24 0	25 3½	27 0	10 15	17 15	3 13	5 15
10. Dumfries,	25 1¾	22 0	30 0	29 2	32 2½	29 1¼	27 3¾	26 2¼	28 3¼	29 3	13 10	14 4½	3 5	4 14
11. Edinburgh,	28 2¼	30 0¼	35 0¾	36 2¼	35 1¾	35 1½	32 2	42 3¼	33 3¼	30 2	14 2¼	14 15¾	2 7¾	5 17¾
12. Elgin,	30 0	24 0	35 3	33 0	34 2	28 1	30 0	26 2	28 0	23 2	15 0	12 4	3 5	5 0
13. Fife,	26 3¼	25 1	32 3¼	33 2¾	37 1¼	33 1¾	33 0	34 3¼	30 1¼	27 2¾	13 2½	15 0	2 8¼	4 11
14. Forfar,	28 1¼	26 3	34 2½	31 0¾	38 3½	32 3¾	30 1	29 3¼	33 2	27 3¼	14 7½	12 15½	2 8¼	4 13
15. Haddington,	28 0¾	28 0½	39 3½	40 3¼	43 1¾	45 3¼	38 0	38 0¼	28 2¼	29 3¼	14 12¾	15 5½	2 18¼	6 14¼
16. Inverness,	28 0	24 2¼	28 1¼	29 1	27 3	26 2	23 0	20 3	22 3¼	22 3	13 4½	13 19¾	1 19½	4 3½
17. Kincardine,	31 3¾	30 2	36 3	33 0	40 0½	33 1	36 1	32 2	36 0	33 0	16 10½	16 0	3 1	5 15
18. Kinross,	28 2¼	29 1	29 0½	30 0	31 1¾	31 2	29 0½	30 0	25 0	22 3	11 2½	13 10	3 5¾	4 0
19. Kirkcudbright,	24 2	24 3¾	30 3¼	30 0¼	32 2	29 3	28 2½	24 3	32 0¼	27 2¾	14 8	15 15¼	2 12¼	4 11¾
20. Lanark,	32 2½	28 1¼	33 1¼	34 2	34 0½	31 3	33 0¾	31 2	29 0¼	29 0¼	10 3¾	13 18¾	3 1¾	5 4¼
21. Linlithgow,	28 2	29 3	33 3	34 1	30 3	30 3	19 2	33 3	28 0	28 1	12 12	13 16	2 12	5 3
22. Nairn,	28 2	25 0	34 3	32 2	31 2	25 3	32 2	31 0	23 2	24 0	13 18	11 0	3 0	3 17
23. { Orkney,	27 2¾	26 0¾	30 3¾	33 0¾	28 2¾	32 2	33 2½	36 0	—	—	16 19	14 2	5 10	4 16¼
Zetland,	—	—	—	—	30 0	—	30 0	—	—	—	15 0	—	1 10	—
24. Peebles,	28 2¼	26 3¾	31 0½	30 3	28 3	34 2	19 0	38 0¼	16 0¼	14 0¼	12 10	13 9½	3 0	4 14¼
25. Perth,	25 0	25 1	29 1	27 3	33 0½	28 0	29 2¾	29 0¼	27 0¼	25 0	12 9	12 10½	2 11	4 10¼
26. Renfrew,	30 3	25 0½	34 1	35 0½	35 1¾	33 3	26 1	29 1¼	26 2¼	29 0¾	10 7½	15 9½	3 6	6 0
27. Ross and Cromarty,	28 3¾	26 0	35 2¼	33 0¼	37 3¼	30 2¼	30 3	27 3¾	27 0¼	24 3½	15 10	14 7¾	2 16	4 12¾
28. Roxburgh,	27 1¾	25 2¾	34 1¾	31 3¼	37 3	35 0¾	28 1¼	32 0	29 3¼	27 2¾	16 17	12 17	2 5¾	5 6
29. Selkirk,	30 3	31 2	33 0	34 0	33 2	38 0	31 2	34 0	21 3	17 2	17 18	16 5	2 9½	5 19
30. Stirling,	28 1½	27 2¼	31 3¼	32 0¾	32 2¾	31 0	—	33 1¼	27 0¾	26 2	11 3¼	13 14	2 17¾	5 0
31. Sutherland,	35 0½	34 1¾	36 0½	34 0	37 0½	32 2¼	29 1¾	27 2¾	19 1¾	8 0	16 3	16 4	3 5¾	4 8
32. Wigtown,	22 2½	23 2¾	30 2¾	35 2½	33 1½	30 0½	27 3¼	28 2	26 2½	25 2	13 7	14 6¼	2 2½	4 1¾

TABLE No. V.—Estimate of Average Acreable Produce per District.

DISTRICTS.	Wheat 1856 Bush.	Wheat 1856 Pecks.	Wheat 1855 Bush.	Wheat 1855 Pecks.	Barley 1856 Bush.	Barley 1856 Pecks.	Barley 1855 Bush.	Barley 1855 Pecks.	Oats 1856 Bush.	Oats 1856 Pecks.	Oats 1855 Bush.	Oats 1855 Pecks.	Rye 1856 Bush.	Rye 1856 Pecks.	Rye 1855 Bush.	Rye 1855 Pecks.
1. Aberdeen.																
District No. 1, ...	26	0½	26	2	30	2	31	1	31	2½	31	3	23	2½	29	—
District No. 2, ...	26	3½	27	2¼	33	3¼	31	3¼	32	1	29	2½	18	1	19	—
District No. 3, ...	28	2	28	0½	36	2	33	1½	34	—	31	—	22	1	26	—
District No. 4, ...	28	1¼	28	—	33	2	32	2	32	1	32	2	24	—	24	—
District No. 5, ...	28	1	30	—	35	1¼	37	3¼	34	0½	33	—	26	3½	24	—
2. Argyll.																
District No. 1, ...	34	1	27	—	50	1	38	2	37	—	32	—	—	—	—	—
District No. 2, ...	—	—	15	3½	24	3	24	3	25	3	25	2¼	—	—	—	—
District No. 3, ...	30	—	32	1¼	32	—	38	3	37	3	30	—	—	—	—	—
District No. 4, ...	30	1	32	—	37	—	41	1	41	1	40	—	30	—	—	—
District No. 5, ...	23	—	—	—	27	—	28	3	28	—	24	0¾	24	2	27	3
District No. 6, ...	—	—	—	—	—	—	27	—	30	—	23	—	—	—	25	—
District No. 7, ...	—	—	—	—	—	—	—	—	23	3	30	—	—	—	—	—
District No. 8, ...	—	—	—	—	—	—	—	—	14	1	14	1	14	—	14	—
District No. 9, ...	—	—	—	—	—	—	—	—	28	2	28	2¼	—	—	—	—
District No. 10, ...	—	—	—	—	—	—	—	—	30	—	24	—	—	—	—	—
3. Ayr.																
District No. 1, ...	24	2	25	1	34	—	32	—	37	2	34	1	22	3	20	—
District No. 2, ...	24	1¼	26	3¼	29	2	34	1½	35	2¼	34	3¾	36	—	32	—
District No. 3, ...	27	—	26	—	29	2	35	2	41	2	41	—	26	—	30	—
District No. 4, ...	26	—	29	—	36	—	35	2	45	—	40	2	36	—	31	1
District No. 5, ...	27	1½	24	0¼	34	2	33	2	46	2¼	43	—	23	—	22	2
4. Banff.																
District No. 1, ...	29	—	26	2⅞	35	2½	37	1⅜	34	1¼	29	2¼	24	0¾	22	—
District No. 2, ...	28	3	28	3	32	1	31	3	31	—	32	1	—	—	—	—
5. Berwick.																
District No. 1, ...	29	—	27	2	32	2½	31	3¼	36	—	34	1½	24	—	—	—
District No. 2, ...	28	—	27	2	33	0½	32	3	36	2	36	3	23	—	16	—
6. Bute and Arran.																
District No. 1, ...	27	3¼	30	2	30	0½	38	0¼	36	2	32	3¾	30	0½	—	—
District No. 2, ...	25	1½	25	1½	34	3½	34	3½	28	2	25	1½	22	0¾	23	3¼
7. Caithness.																
District No. 1, ...	32	—	32	—	36	1	32	—	34	3	35	—	—	—	—	—
District No. 2, ...	28	—	34	—	28	—	30	—	33	—	32	—	—	—	—	—

DISTRICTS.	Bere 1856 Bush.	Bere 1856 Pecks.	Bere 1855 Bush.	Bere 1855 Pecks.	Beans and Pease 1856 Bush.	Beans and Pease 1856 Pecks.	Beans and Pease 1855 Bush.	Beans and Pease 1855 Pecks.	Turnips 1856 Tons.	Turnips 1856 Cwts.	Turnips 1855 Tons.	Turnips 1855 Cwts.	Potatoes 1856 Tons.	Potatoes 1856 Cwts.	Potatoes 1855 Tons.	Potatoes 1855 Cwts.	Mangold 1856 Tons.	Mangold 1856 Cwts.	Mangold 1855 Tons.	Mangold 1855 Cwts.
1. Aberdeen.																				
District No. 1, ...	29	1½	32	1	21	1½	25	3¼	15	7	15	19	3	19	6	14	9	10	10	—
District No. 2, ...	35	2	33	0½	25	—	27	—	15	11	16	6¼	3	17	5	9½	—	—	—	—
District No. 3, ...	35	—	34	3¾	30	—	34	0½	15	18	14	13¾	4	6	5	7	16	2½	13	5
District No. 4, ...	37	1	35	2	—	—	24	1	15	10	14	14	4	5	5	14	—	—	—	—
District No. 5, ...	38	3¾	35	3	—	—	20	2	15	16½	15	19	4	8	5	15	12	11¾	12	—
2. Argyll.																				
District No. 1, ...	—	—	—	—	28	—	30	—	12	15	17	10	2	—	5	10	—	—	16	10
District No. 2, ...	24	0¾	25	2¼	31	1	25	3¾	9	2	15	2	1	10	4	11¼	8	2	15	1¼
District No. 3, ...	43	—	36	3	21	—	26	1	10	2	15	8	1	5	5	2	4	—	16	—
District No. 4, ...	38	—	42	2	29	—	33	—	12	13	17	4	2	9	5	—	14	15	4	4
District No. 5, ...	27	0¾	24	—	13	2	14	1	10	12	14	—	1	5	4	15¼	5	7	15	6
District No. 6, ...	39	—	30	—	—	—	—	—	10	—	20	10	3	—	7	10	—	—	—	—
District No. 7, ...	13	2	18	—	—	—	—	—	3	15	5	—	2	7½	3	—	—	—	—	—
District No. 8, ...	13	1	16	1	—	—	—	—	13	10	15	—	2	10	5	10	—	—	—	—
District No. 9, ...	27	3	33	1¼	—	—	—	—	5	—	9	10¼	1	—	3	11¼	—	—	—	—
District No. 10, ...	40	—	36	—	—	—	—	—	12	—	18	—	2	—	5	10	—	—	—	—
3. Ayr.																				
District No. 1, ...	—	—	26	2	27	—	26	1	10	5	15	8	2	1	3	14	8	4	17	5
District No. 2, ...	29	1¼	31	0¾	22	0½	25	1½	6	11	18	12	1	17	4	11½	7	2	16	1
District No. 3, ...	29	—	33	—	23	—	28	2	10	5	17	10	2	—	4	15	9	10	14	10
District No. 4, ...	38	—	36	3	28	—	29	3	9	—	16	—	3	—	4	—	7	—	14	16
District No. 5, ...	39	1¾	42	3	21	2½	28	2	10	19	16	16	2	7½	4	2	7	18	13	13
4. Banff.																				
District No. 1, ...	32	1½	33	2	28	2	32	—	15	—	14	14	3	—	5	1	—	—	—	—
District No. 2, ...	29	3	30	—	—	—	—	—	12	7	13	14	4	2	5	7¼	—	—	—	—
5. Berwick.																				
District No. 1, ...	30	—	30	—	29	3½	27	2¼	15	5	12	11	3	8	6	15¾	15	10	18	—
District No. 2, ...	30	—	39	—	26	—	25	2	16	—	13	2½	4	4	8	13½	17	—	16	5
6. Bute and Arran.																				
District No. 1, ...	—	—	—	—	28	2	23	2½	10	15	15	11¾	2	2	5	9¾	10	6	15	17¼
District No. 2, ...	31	3	34	3½	22	1	22	0¾	6	7	10	6¼	1	4	4	7¼	9	10	11	2
7. Caithness.																				
District No. 1, ...	34	—	32	2	—	—	—	—	19	15	15	10	4	18	3	15	—	—	—	—
District No. 2, ...	34	—	34	—	—	—	—	—	18	—	17	10	4	—	4	10	—	—	—	—

TABLE No. V.—Estimate of Average Acreable Produce per District—*Continued.*

DISTRICTS.	WHEAT. 1856. Bush.	WHEAT. 1856. Pecks.	WHEAT. 1855. Bush.	WHEAT. 1855. Pecks.	BARLEY. 1856. Bush.	BARLEY. 1856. Pecks.	BARLEY. 1855. Bush.	BARLEY. 1855. Pecks.	OATS. 1856. Bush.	OATS. 1856. Pecks.	OATS. 1855. Bush.	OATS. 1855. Pecks.	RYE. 1856. Bush.	RYE. 1856. Pecks.	RYE. 1855. Bush.	RYE. 1855. Pecks.
8. CLACKMANNAN, ...	30	1	28	—	34	3	32	—	38	1	33	2	—	—	28	3
9. DUMBARTON, ...	30	2½	27	2	31	3¼	32	—	35	3½	34	2	—	—	—	—
10. DUMFRIES.																
District No. 1, ...	22	—	20	3¼	27	1	28	3	31	—	28	3¾	15	3	—	—
District No. 2, ...	26	2	23	—	31	2	30	2½	33	3	29	1½	28	—	23	3
District No. 3, ...	25	—	19	—	27	2	27	—	31	—	28	2	35	—	20	—
District No. 4, ...	24	3¾	21	2	31	1	31	—	35	2	32	3	35	2¼	26	2
District No. 5, ...	24	2	22	1	27	2	23	—	27	2	22	3	30	—	24	—
11. EDINBURGH.																
District No. 1, ...	30	—	31	2	37	—	37	1¾	36	3	35	3¼	—	—	20	—
District No. 2, ...	30	1½	31	1¾	37	2	40	0¾	40	—	40	3	—	—	25	1½
District No. 3, ...	23	3	26	0¾	32	—	32	0½	32	3	32	2¾	—	—	—	—
12. ELGIN, ...	30	—	24	—	35	3	33	—	34	2	28	1	26	2	24	2
13. FIFE.																
District No. 1, ...	27	1¾	25	0¼	33	1¾	33	3¼	34	2	29	2¼	23	3	—	—
District No. 2, ...	28	1	26	3	34	3	35	—	37	1	34	1	30	1	32	3
District No. 3, ...	25	3	24	1½	31	3	33	1	38	3	35	0½	25	1½	22	1
District No. 4, ...	26	3	24	3	32	1	33	—	37	3	33	2	24	—	20	—
14. FORFAR.																
District No. 1, ...	26	1½	26	0¾	34	3½	31	2¾	39	2½	34	3½	31	3	28	2¼
District No. 2, ...	30	1½	27	1½	34	1¾	30	3¼	38	0½	31	0¼	19	0½	13	3
15. HADDINGTON.																
District No. 1, ...	25	0¾	26	0½	36	2	36	3	36	1¾	37	1½	—	—	—	—
District No. 2, ...	24	0½	23	3¾	35	2¾	37	0¼	41	2¾	41	1¼	—	—	—	—
District No. 3, ...	30	0½	28	2¼	44	2	44	1½	50	3	53	3¾	—	—	—	—
District No. 4, ...	31	3	31	2¾	44	2	43	0¾	52	1½	57	0¼	—	—	25	1½
District No. 5, ...	28	1	26	3¼	42	2½	42	—	47	2	47	2½	—	—	40	1¾
District No. 6, ...	28	—	30	—	38	—	45	3½	40	—	47	1¾	24	—	—	—
16. INVERNESS.																
District No. 1, ...	32	—	25	—	32	—	32	—	36	—	26	—	26	—	26	—
District No. 2, ...	24	—	22	—	28	—	26	—	28	—	25	—	—	—	—	—
District No. 3, ...	24	—	24	—	28	—	28	—	28	—	28	1¼	32	—	32	—
District No. 4, ...	30	0½	—	—	26	2	—	—	31	1	30	—	23	3	—	—
District No. 5, ...	—	—	—	—	35	—	36	3¼	25	2	29	1¾	17	2	—	—

DISTRICTS.	BERE. 1856. Bush.	BERE. 1856. Pecks.	BERE. 1855. Bush.	BERE. 1855. Pecks.	BEANS AND PEASE. 1856. Bush.	BEANS AND PEASE. 1856. Pecks.	BEANS AND PEASE. 1855. Bush.	BEANS AND PEASE. 1855. Pecks.	TURNIPS. 1856. Tons.	TURNIPS. 1856. Cwts.	TURNIPS. 1855. Tons.	TURNIPS. 1855. Cwts.	POTATOES. 1856. Tons.	POTATOES. 1856. Cwts.	POTATOES. 1855. Tons.	POTATOES. 1855. Cwts.	MANGOLD. 1856. Tons.	MANGOLD. 1856. Cwts.	MANGOLD. 1855. Tons.	MANGOLD. 1855. Cwts.
8. CLACKMANNAN, ...	—	—	32	—	30	2	29	1	14	14	17	1	2	1	4	9	13	—	15	2
9. DUMBARTON, ...	30	3¼	24	—	25	3½	27	—	10	15	17	15	3	13	5	15	7	7	13	—
10. DUMFRIES.																				
District No. 1, ...	20	2	25	3	25	1	27	2¼	15	4	16	1¼	2	8	3	15¼	14	13	13	1¾
District No. 2, ...	—	—	33	—	29	2	31	—	14	10	15	1	3	10	5	1	11	10	16	16
District No. 3, ...	30	—	27	—	22	—	21	—	12	5	15	—	3	15	5	—	8	12	15	—
District No. 4, ...	31	3¼	24	—	31	1¾	33	1	12	7½	12	4	3	10½	5	3	13	11½	10	4
District No. 5, ...	24	—	25	—	25	—	20	—	10	12	11	2	2	7	3	5	14	—	5	—
11. EDINBURGH.																				
District No. 1, ...	—	—	—	—	33	1	32	1	15	19	17	11	2	5	5	6	14	10	15	17½
District No. 2, ...	—	—	44	1¾	34	2¾	34	3½	17	16	18	1¼	2	10	6	11¼	17	5	18	0¼
District No. 3, ...	32	2	42	3¼	—	—	26	0¾	11	10	11	18¾	2	8	5	0¾	8	14	11	2
12. ELGIN, ...	30	—	26	2	28	—	23	2	15	—	12	4	3	5	5	—	14	—	10	5
13. FIFE.																				
District No. 1, ...	27	—	—	—	28	—	24	2¼	12	6	15	18	2	—	4	15	12	14	14	5½
District No. 2, ...	32	3	30	—	32	—	30	1	12	6	14	9	2	5	5	3	13	5	15	8
District No. 3, ...	—	—	20	2	30	0½	27	3	13	10	14	12	2	7½	5	—	8	10	12	12
District No. 4, ...	34	3	38	2	31	2	29	—	13	16	15	8	2	11	4	—	10	10	9	9
14. FORFAR.																				
District No. 1, ...	31	3	31	2¾	35	2½	25	1½	13	10	12	13¾	4	3	3	19¼	8	—	11	18
District No. 2, ...	27	2¼	25	3¼	32	3½	28	3	15	4½	12	17¼	2	15	5	6¼	14	1½	11	12
15. HADDINGTON.																				
District No. 1, ...	—	—	—	—	22	2	27	1½	13	—	14	0¾	2	5	5	12¾	14	5	11	3
District No. 2, ...	38	—	38	0¼	27	2	29	1¾	13	5½	14	5½	2	5	6	0¼	11	18	9	6¼
District No. 3, ...	—	—	—	—	31	3	31	2¾	14	5	15	17¼	3	—	7	2¾	13	10	14	5½
District No. 4, ...	—	—	—	—	33	1¼	31	2¾	19	—	17	3¼	2	7½	6	5½	19	—	17	9¼
District No. 5, ...	—	—	38	0¼	28	3	29	3¼	14	6	15	2¾	3	10	7	3½	16	3	21	3½
District No. 6, ...	—	—	—	—	30	—	29	1½	14	—	15	12¾	4	—	7	16½	16	—	29	12½
16. INVERNESS.																				
District No. 1, ...	30	—	30	—	28	—	24	—	10	—	10	—	2	—	4	—	8	—	8	—
District No. 2, ...	31	—	26	—	16	—	20	—	17	—	16	—	1	—	3	10	9	—	11	—
District No. 3, ...	32	—	32	—	18	—	20	—	16	—	15	—	1	—	4	—	9	—	12	—
District No. 4, ...	29	2	30	—	16	—	—	—	11	—	14	12	3	5	4	7	—	—	—	—
District No. 5, ...	36	2½	40	—	16	2	—	—	8	18	16	—	2	8	5	17¼	8	—	—	—

Table No. V.—Estimate of Average Acreable Produce per District—*Continued.*

DISTRICTS.	Wheat 1856 Bush.	Wheat 1856 Pecks.	Wheat 1855 Bush.	Wheat 1855 Pecks.	Barley 1856 Bush.	Barley 1856 Pecks.	Barley 1855 Bush.	Barley 1855 Pecks.	Oats 1856 Bush.	Oats 1856 Pecks.	Oats 1855 Bush.	Oats 1855 Pecks.	Rye 1856 Bush.	Rye 1856 Pecks.	Rye 1855 Bush.	Rye 1855 Pecks.
16. Inverness—*Continued.*																
District No. 6,	—	—	—	—	26	—	19	3¼	21	2¼	21	1½	—	—	—	—
District No. 7,	—	—	—	—	—	—	—	—	—	—	9	—	—	—	—	—
District No. 8,	—	—	—	—	—	—	—	—	12	3½	12	2¾	14	3	14	1
District No. 9,	—	—	—	—	—	—	—	—	—	—	12	2¾	—	—	11	0½
District No. 10,	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
District No. 11,	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17. Kincardine.	31	3¾	30	2	36	3	33	—	40	0½	33	1	29	3	26	3
18. Kinross,	28	2¼	29	1	29	0½	30	—	31	1¾	31	2	28	—	25	—
19. Kirkcudbright.																
District No. 1,	23	2¼	24	2¼	31	—	30	0½	32	3¾	28	3¼	24	0¾	26	3¾
District No. 2,	24	—	25	—	29	—	28	—	32	—	32	—	34	—	—	—
District No. 3,	27	3	26	0¾	33	—	32	1¼	33	1¼	28	3	23	3	29	1¼
District No. 4,	—	—	—	—	24	3	23	1	28	1	29	2	16	—	19	—
20. Lanark.																
District No. 1,	33	1¾	28	2¼	34	0½	35	1¼	37	1	35	1¼	—	—	30	0½
District No. 2,	25	1½	25	1½	31	3	32	2	30	0½	26	3¾	28	2	30	0½
21. Linlithgow,	28	2	29	3	33	3	34	1	30	3	30	3	17	1	—	—
22. Nairn,	28	2	25	—	34	3	32	2	31	2	25	3	34	—	30	—
23. Orkney.																
District No. 1,	25	0½	27	—	25	0½	—	—	28	—	31	3½	—	—	—	—
District No. 2,	33	—	24	—	32	3	33	0¾	30	2	35	1	—	—	—	—
District No. 3,	—	—	—	—	—	—	—	—	23	3	21	3¾	—	—	—	—
Zetland,	—	—	—	—	—	—	—	—	30	—	—	—	—	—	—	—
24. Peebles,	28	2¼	26	3¾	31	0½	30	3	28	3	34	2	—	—	—	—
25. Perth.																
District No. 1,	25	2	27	3¾	34	3½	27	2¾	41	2½	30	3½	—	—	22	0¾
District No. 2,	24	—	27	2	24	—	31	—	30	2	31	1	20	—	—	—
District No. 3,	22	—	20	1	27	3	23	—	33	1	23	1½	18	1	16	2½
District No. 4,	27	0¾	25	2½	31	0¾	29	1	37	1	27	1	12	2¾	19	—
District No. 5,	21	0½	22	1¼	25	3½	23	2¾	29	—	26	3	13	—	—	—
District No. 6,	25	2	22	3¾	27	1¾	22	2	25	2	24	0	—	—	28	1

DISTRICTS.	Bere 1856 Bush.	Bere 1856 Pecks.	Bere 1855 Bush.	Bere 1855 Pecks.	Beans and Pease 1856 Bush.	Beans and Pease 1856 Pecks.	Beans and Pease 1855 Bush.	Beans and Pease 1855 Pecks.	Turnips 1856 Tons.	Turnips 1856 Cwts.	Turnips 1855 Tons.	Turnips 1855 Cwts.	Potatoes 1856 Tons.	Potatoes 1856 Cwts.	Potatoes 1855 Tons.	Potatoes 1855 Cwts.	Mangold 1856 Tons.	Mangold 1856 Cwts.	Mangold 1855 Tons.	Mangold 1855 Cwts.
16. Inverness—*Continued.*																				
District No. 6,	22	2½	19	3¼	—	—	—	—	12	6	17	9	3	4	3	17	—	—	—	—
District No. 7,	—	—	10	—	—	—	—	—	—	—	6	—	—	—	2	—	—	—	—	—
District No. 8,	20	—	19	—	—	—	—	—	12	5	14	5¼	—	—	3	11¼	—	—	—	—
District No. 9,	—	—	15	3½	—	—	—	—	—	—	12	13¾	—	—	3	11¼	—	—	—	—
District No. 10,	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
District No. 11,	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17. Kincardine.	36	1	32	2	36	—	33	—	16	10½	16	—	3	1	5	15	13	6	12	—
18. Kinross,	29	0½	30	—	25	—	22	3	11	2½	13	10	3	5¾	4	—	—	—	16	—
19. Kirkcudbright.																				
District No. 1,	—	—	—	—	29	1¼	31	0¾	14	2	14	15¼	2	10	4	16¼	12	13	14	13½
District No. 2,	33	—	—	—	28	—	26	—	14	—	16	8	2	10	4	15	12	—	12	—
District No. 3,	15	3½	26	3¾	37	1	23	3¼	16	3	17	1	3	—	3	12¼	14	5	15	1¼
District No. 4,	23	1	23	2	16	—	24	—	10	7½	13	6	2	12	5	1½	10	8	—	—
20. Lanark.																				
District No. 1,	—	—	30	0½	30	0¼	29	3	11	2	15	10	3	12	5	17¼	11	9	14	5½
District No. 2,	33	1	32	2	22	1	24	2¾	9	10	12	13¾	2	—	3	19¼	10	6	11	18
21. Linlithgow,	19	2	33	3	28	—	28	1	12	12	13	16	2	12	5	3	10	19	12	13
22. Nairn,	32	2	31	—	23	2	24	—	13	18	11	—	3	—	3	17	16	—	16	—
23. Orkney.																				
District No. 1,	29	2	36	2¼	—	—	—	—	16	13	12	12¼	5	13	4	16¼	—	—	—	—
District No. 2,	36	—	36	1	—	—	—	—	17	—	14	12	5	8	4	16¼	—	—	—	—
District No. 3,	29	—	31	2¼	—	—	—	—	18	6	17	10¼	5	10	4	16	—	—	—	—
Zetland,	30	—	—	—	—	—	—	—	15	—	—	—	1	10	—	—	—	—	—	—
24. Peebles,	19	—	38	0¼	16	0¼	14	0¼	12	10	13	9½	3	—	4	14¼	9	10	7	2¾
25. Perth.																				
District No. 1,	—	—	—	—	29	2½	25	—	17	15	13	19½	1	5	4	18¼	15	17	14	5
District No. 2,	22	—	21	—	27	—	24	—	12	15	11	4	2	6	4	5	9	—	9	—
District No. 3,	—	—	23	3¼	27	3	17	1¾	10	14	9	8¾	2	6	3	1	—	—	—	—
District No. 4,	23	3	34	0½	28	—	24	3	12	16	14	—	3	4	5	0¾	9	10	—	—
District No. 5,	22	1	—	—	22	1½	22	0¾	10	8	10	19¾	2	2½	4	1¾	8	—	9	10¼
District No. 6,	19	—	—	—	24	3	26	3¼	10	13	14	—	3	3	4	15	17	9	20	—

TABLE No. V.—Estimate of Average Acreable Produce per District—*Continued.*

DISTRICTS.	Wheat.				Barley.				Oats.				Rye.				Bere.				Beans and Pease.				Turnips.				Potatoes.				Mangold.			
	1856.		1855.		1856.		1855.		1856.		1855.		1856.		1855.		1856.		1855.		1856.		1855.		1856.		1855.		1856.		1855.		1856.		1855.	
	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Bush.	Pecks.	Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.
25. PERTH—*Continued.*																																				
District No. 7, ...	30	—	29	—	33	—	31	—	34	1	31	3	21	—	20	—	30	3	32	—	25	—	25	—	9	10	11	10	3	5	5	4	12	—	15	—
District No. 8, ...	32	—	30	1	33	2	27	—	42	1	29	3	24	—	18	—	31	2	25	3	30	—	17	—	17	9	17	13	4	2	5	0½	9	12	—	—
District No. 9, ...	26	—	24	2	33	—	32	—	39	3	31	—	20	—	18	—	30	2	28	—	36	—	23	—	12	9	13	2	2	6	4	10	—	—	—	—
26. RENFREW.																																				
District No. 1, ...	33	1	28	3	38	1	37	1	38	—	36	3	—	—	—	—	35	1	—	—	30	2	36	—	10	6	15	5	2	15	6	2	9	2	12	—
District No. 2, ...	30	3	23	2	33	0¼	32	2	41	1¾	33	2¼	—	—	—	—	31	3	30	3¾	25	—	27	2	11	1	16	—	3	4	6	2	8	12	15	1¼
District No. 3, ...	29	1¼	26	1¼	32	1¾	35	2¾	34	2	35	2¾	22	0¾	25	1¼	22	0¾	28	2¼	26	3	27	2¼	11	10	17	12	3	19	6	10	9	7	7	2¾
District No. 4, ...	30	0½	29	0¼	26	0¾	26	3¾	24	0¾	24	2¼	31	3	26	3¾	23	3	30	0½	23	—	22	0¾	7	10½	11	2	2	7½	3	19¼	—	—	7	18½
27. ROSS AND CROMARTY.																																				
District No. 1, ...	30	—	25	—	37	—	35	—	39	1	33	2	25	2	24	—	—	—	24	—	29	1	25	1¼	18	—	15	—	3	6	4	7	9	5	10	—
District No. 2, ...	28	—	27	—	35	—	32	—	38	—	29	—	22	2	26	—	26	—	—	—	25	2	24	2	13	16½	13	18	2	10½	4	17	7	15	8	—
District No. 3, ...	—	—	—	—	33	—	—	—	32	—	32	2	—	—	—	—	34	—	35	—	—	—	—	—	12	—	15	—	3	—	5	—	—	—	—	—
District No. 4, ...	—	—	—	—	32	—	32	—	30	—	30	—	—	—	—	—	30	—	28	—	32	—	30	—	13	—	14	—	3	—	3	10	—	—	—	—
District No. 5, ...	—	—	—	—	29	2	28	1½	30	—	28	1½	—	—	—	—	26	2	26	2½	—	—	—	—	13	4	16	10½	2	5	4	9	10	—	—	—
District No. 6, ...	—	—	—	—	—	—	—	—	31	2	26	—	—	—	—	—	31	2	28	—	—	—	—	—	19	5	14	—	3	10	6	—	—	—	—	—
28. ROXBURGH.																																				
District No. 1, ...	26	3	27	3	38	—	36	—	41	—	40	1	—	—	—	—	40	—	—	—	32	—	30	—	17	10	14	—	3	5	6	15	10	—	12	—
District No. 2, ...	30	—	26	—	35	2	30	—	41	2	35	—	24	—	24	—	—	—	—	—	33	—	26	—	17	—	11	—	3	—	7	—	15	—	—	—
District No. 3, ...	29	—	25	3	35	—	32	2	42	—	38	3	20	—	24	—	—	—	—	—	36	—	35	—	19	—	14	4½	3	10	6	—	—	—	10	—
District No. 4, ...	27	—	24	1½	33	—	30	2¼	37	—	36	1	—	—	—	—	—	—	—	—	30	—	29	3	15	14	11	12½	1	7	4	12¾	8	13	14	—
District No. 5, ...	24	3	23	1½	32	0¾	30	—	34	2½	32	2	16	—	—	—	30	—	31	2¼	24	1	23	2½	15	5	12	3½	1	10	4	6	—	—	8	—
District No. 6, ...	29	—	29	—	33	—	30	—	36	—	32	—	—	—	—	—	25	—	36	—	30	—	28	—	18	10	14	10	2	—	4	14	—	—	5	—
District No. 7, ...	—	—	—	—	29	—	27	—	36	—	32	—	—	—	—	—	—	—	—	—	—	—	—	—	11	—	12	10	1	10	4	10	—	—	—	—
29. SELKIRK, ...	30	3	31	2	33	—	34	—	33	2	38	—	—	—	—	—	31	2	34	—	21	3	17	2	17	18	16	5	2	9½	5	19	—	—	—	—
30. STIRLING.																																				
District No. 1, ...	28	1½	27	2¼	33	0½	33	1¼	35	1	32	2¾	—	—	—	—	—	—	33	1¼	27	1½	27	0½	11	14	13	13	2	7	4	16	10	6	—	—
District No. 2, ...	28	1½	27	2	26	2	27	—	29	—	28	1½	—	—	—	—	—	—	—	—	26	1	23	1½	10	—	13	16¾	3	10	5	4	4	10	—	—
31. SUTHERLAND.																																				
District No. 1, ...	—	—	—	—	—	—	—	—	38	2	30	—	—	—	—	—	34	1	33	1	—	—	30	—	16	10	14	10	3	16	4	—	—	—	—	—
District No. 2, ...	—	—	—	—	29	—	32	—	27	2	26	2	—	—	—	—	28	—	31	—	—	—	—	—	12	—	13	15	3	6	6	—	—	—	—	—
District No. 3, ...	34	—	28	—	37	2	34	—	37	—	30	3½	27	—	—	—	32	—	28	—	8	—	8	—	14	—	12	18	3	5	4	12	—	—	—	—
District No. 4, ...	35	3	37	—	34	2	34	—	37	—	38	—	30	—	20	—	22	—	18	—	24	—	—	—	19	8	21	—	3	4	3	10	—	—	—	—
32. WIGTOWN.																																				
District No. 1, ...	23	2	26	3¾	31	1¼	36	3½	34	1½	33	2¾	25	3	*28	2¼	29	1¼	36	2	30	0½	24	2¼	14	3½	14	5½	2	10	5	3	10	—	13	5½
District No. 2, ...	22	1	22	1½	26	3¼	26	3¾	32	1¾	26	3	26	—	27	0¾	27	3	28	0½	21	—	26	3¾	12	13	14	7	1	17	3	4¼	9	19	13	11¼

TABLE VI.—WEIGHTS OF GRAIN PER BUSHEL IN EACH DISTRICT.

DISTRICTS.	Wheat.	Barley.	Oats.	Bere.	Beans & Pease.
	lb.	lb.	lb.	lb.	lb.
ABERDEEN—					
District 1,	50 to 60	48 to 55	35 to 41	48 to 55	...
Do. 2,	57	53	40	52	...
Do. 3,	...	52	41	50	...
Do. 4,	...	50 to 55	37 to 40	52 to 54	...
Do. 5,	58	51	39	49	...
ARGYLL—					
District 1,	60	53	38	...	...
Do. 2,	...	50	39½	47¼	59
Do. 3,	60	51	42	49	64
Do. 4,	58	53	40	50	63
Do. 5, 6, 7, 8, 9, 10,	...	...	38	49	...
AYR—					
District 1,	59	52	37	...	63
Do. 2,	58½	...	36	...	...
Do. 3,	58	50½	34	48	58
Do. 4,	58	...	34	...	57
Do. 5,	58	50	34	46	62
BANFF—					
District 1,	56	52	40	50	...
Do. 2,	57½	51½	40½	51	...
BERWICK—					
District 1,	55½ to 61½	50 to 54	39 to 42½	...	...
Do. 2,	57⅓	51¾	39⅘	48	62⅔
BUTE AND ARRAN—					
District 1,	59	53	39	...	60
Do. 2,	58	51	36	47	63
CAITHNESS—					
District 1,	56	48 to 51	35 to 40	46 to 50	...
Do. 2,	58	50	38	49	...
CLACKMANNAN—	54 to 63	45 to 54	37 to 42½	...	60
*DUMBARTON—	60	50	41	46	58
DUMFRIES—					
District 1,	...	...	...	...	...
Do. 2,	60	51¼	40	...	63
Do. 3,	59½	51¼	38½	49½	58½
Do. 4,	60	52	40	...	62
Do. 5,	59	52	39	...	...
EDINBURGH—					
District 1,	59⅗	51⅝	39½	...	61
Do. 2,	58	52	40	...	61
Do. 3,	56 to 59	48 to 51	36 to 40	47	57 to 60

* In those districts marked with an asterisk, the weight of grain refers only to what was secured in good condition.

TABLE VI.—WEIGHTS OF GRAIN—*Continued.*

Districts.	Wheat.	Barley.	Oats.	Bere.	Beans & Pease.
	lb.	lb.	lb.	lb.	lb.
ELGIN—	60	53½	39 to 40	50	60
FIFE—					
District 1,	60	50	39	...	60
Do. 2,	49 to 64½	44 to 56	32 to 45	...	54 to 63
Do. 3,	55 to 61	50	39	...	60
Do. 4,	56 to 61	48 to 52	38 to 42	...	60
FORFAR—					
District 1,	57	51	40	48	58
Do. 2,	59	50	39	48	62
HADDINGTON—					
District 1,	56 to 62	48 to 56	37 to 44	...	...
Do. 2,	56 to 62	48 to 54	37 to 42	...	63
* Do. 3,	62	53	42	...	65
Do. 4,	59 to 62	52 to 55	40 to 44	...	64
* Do. 5,	58 to 62	55	42	...	65
Do. 6,	57	52	38	...	64
INVERNESS—					
District 1,	56	51	39	48	60
Do. 2,	59 to 60	50 to 51	38 to 40	49 to 50	...
Do. 3,	59 to 60	50 to 51	38 to 40	49 to 50	55 to 55
Do. 4,	...	49	38	47	...
Do. 5,	...	51	40	49	...
Do. 6,	...	45 to 50	40	44	...
Do. 7, 8, 9, 10, 11,	...	...	27	47½	...
KINCARDINE—	57½	50¾	39	50¼	62
KINROSS—	54½	47 to 52	36	...	...
KIRKCUDBRIGHT—					
District 1,	58¾	50½	39¼	...	62
Do. 2,	58	52	39	...	...
Do. 3,	60	52	40	...	...
Do. 4,	...	49	37½	44¾	50
LANARK—					
District 1,	58	51	36½	...	61
Do. 2,	56	48	37	48	55
LINLITHGOW—	58	52	37	...	62
NAIRN—	60	53	40	51	58
ORKNEY—					
Mainland, 1,	58½	50	38	47	...
North Isles, 2,	58½	51	39	48	...
South Isles, 3,	...	...	38	48	...
ZETLAND—	...	...	...	...	...

TABLE VI.—WEIGHTS OF GRAIN—*Continued.*

Districts.	Wheat.	Barley.	Oats.	Bere.	Beans & Pease.
	lb.	lb.	lb.	lb.	lb.
PEEBLES—	...	52	39	...	...
PERTH—					
District 1,...............	58 to 60	48 to 52	36 to 40	...	60
Do. 2,...............	58½	49	38½	...	57
Do. 3,...............	56	50	41	...	...
Do. 4,...............	58 to 59	48 to 50	39	...	59
Do. 5,...............	57	50	39½	...	60
* Do. 6,...............	61½	52	41	...	64½
Do. 7,...............	59½	52½	40	47	62
Do. 8,...............	56	49	40	47	58
Do. 9,...............	58	50	39	48	...
RENFREW—					
District 1,...............	58	51	38	50	...
Do. 2,...............	55	50	34	...	58
Do. 3,...............	58	52½	37¼	...	60
Do. 4,...............	57	...	34	...	...
ROSS AND CROMARTY—					
District 1,...............	54 to 60	48 to 53	36 to 42	...	60
Do. 2,...............	57	50	38	...	...
Do. 3,...............	...	52	40	50	...
Do. 4,...............	...	52	40	...	...
Do. 5,...............	...	52	38½	49	...
Do. 6,...............	...	...	40	49	...
ROXBURGH—					
* District 1,...............	60 to 63	53 to 56	40 to 44	...	...
* Do. 2,...............	62	54	42	...	...
* Do. 3,...............	61 to 63	53 to 56	40 to 42	...	...
Do. 4,...............	57	51	40	...	59
Do. 5,...............	...	...	...	...	...
Do. 6,...............	58½	51½	39	50	60
Do. 7,...............	...	49	38½	...	...
SELKIRK—	...	52	40½	...	...
STIRLING—					
District 1,...............	60¼	52½	40¾	...	60½
Do. 2,...............	54 to 58	48 to 51	33 to 37	...	58
SUTHERLAND—					
District 1,...............	...	...	40	50	...
Do. 2,...............	...	52	40	48	...
Do. 3,...............	...	...	...	...	...
Do. 4,...............	58	54	41	48	58
WIGTOWN—					
District 1,...............	57	50	40	44	61
Do. 2,...............	59	52	39	48	63

LIST OF DISTRICTS, AND ABSTRACTS FROM REPORTS BY ENUMERATORS.

1.—COUNTY OF ABERDEEN.

District No. 1.—(Mar.) Parishes of Aboyne, Alford, Birse, Cluny, Coul, Crathie, Drumoak, Dyce, Echt, Glenmuick, Kemnay, Kincardine-O'Neil, Kinnellor, Leochel-Cushnie, Logie-Coldstone, Lumphanan, Mid-Mar, Monymusk, Newhills, Peterculter, Skene, Strathdon, Tarland, Tough, and Towie. *Enumerator*, Robert Williamson, Bendauch, Blackburn, Aberdeen.

Abstract of Report.—About one-twentieth of the grain secured in good condition, and of fine quality and colour; the deterioration to the remainder by exposure estimated at 20 per cent, except in upper portion of district, where crops were later and suffered less. Much grain stacked in bad condition, and will, it is feared, suffer from heating, and yield inferior meal. Potatoes diseased one-third.

2.—(Formartine.) Belhelvie, Bourtie, Ellon, Fintray, Foveran, Keithhall, Logie-Buchan, New Machar, Old Machar, Methlic, Meldrum, Slains, Tarves, and Udny. *Enumerator*, Robert Copland, Haddo House, Aberdeen.

Abstract of Report.—Except in parish of Old Machar, scarcely any of the crop secured before the rains, and deterioration in value from exposure is estimated at 20 per cent.

3.—(Buchan.) Aberdour, Crimond, Cruden, Old Deer, New Deer, Fraserburgh, King-Edward, Longside, Lonmay, Monquhitter, Peterhead, Pitsligo, Rathen, Strichen, St Fergus and Tyrie. *Enumerator*, John Ferguson, Coynach, Ellon.

Abstract of Report.—Quality of cereals, except barley and bere, generally bad. Wheat ill matured from want of sun; little of the crop secured before rains; portion exposed, ill filled and discoloured, and supposed to be light, but not yet tested. Barley, three-fourths secured in good order; remainder much sprouted and injured. Oats, small proportion secured well; one-fifth lost from sprouting and exposure. Turnips an average crop. Potatoes one-third diseased.

4.—(Garioch.) Auchterless, Chapel of Garioch, Culsalmond, Daviot, Fyvie, Insch, Inverury, Kintore, Leslie, Oyne, Premnay, Rayne, and Turriff. *Enumerator*, George Philip, Boynds, Keithhall.

Abstract of Report.—Wheat and barley ill secured, and still in bad condition. Oats a great crop, but very much damaged; loss from sprouting, &c. estimated at 20 per cent, and quality and condition now bad, but may improve if stacks dry. Bere an excellent crop and well secured. Turnips a full average and of good quality. Potatoes an average crop, but much diseased—in some parishes by one-half.

5.—(Strathbogie.) Auchindoir, Cairney, Clatt, Drumblade, Forgue, Gartly, Glass, Glenbucket, Huntly, Keig, Kildrummy, Kinnethmont, Rhynie, and Tullynessle. *Enumerator*, William Murdoch, Huntly.

Abstract of Report.—Cereals generally inferior. No wheat nor oats—and, except in parish of Tullynessle, little barley or bere—secured before the rains. Loss from exposure may be estimated at about 20 per cent on the whole. Weights of grain vary so as to make an estimate difficult. Turnips good. Mangold an average. Potatoes unequal; about one-sixth unsound, except in Glenbucket, where fully three-fourths of the crop were diseased.

2.—COUNTY OF ARGYLL.

District No. 1.—(Cowal.) Dunoon and Kilmun, Inverchoalin, Kilfinnan, Kilmodan or Glendaruel, Lochgoilhead, and Strachur and Stralachlan. *Enumerator*, Archibald M'Farlane, Clachan, Cairndow.

Abstract of Report.—Grain secured early, and in fine condition. Quality of all crops good. One-fourth of potatoes diseased.

2.—(Argyll.) Craignish, Glassary, Inverary, Kilmartin, North Knapdale, and South Knapdale. *Enumerator*, Neil M'Kechnie, Inverary.

Abstract of Report.—Grain secured early, and in excellent condition; quality good. Potatoes small crop, and much diseased; but cannot estimate proportion, the unsound having rotted before digging.

3.—(Lorn.) Lismore and Appin, Ardchattan, and Mucharn, Glenorchy and Inishail, Kilchattan and Kilbrandon, Kilbride and Kilmore, Kilninver and Kilmelfort, Kilchrennan and Dalavich, and Argyllshire portion of Kilmallie. *Enumerator*, Duncan M'Arthur, Penningfair, Oban.

Abstract of Report.—Grain secured early, and in fine condition; quality good. Turnips and mangold small, but sound. Potatoes nearly an entire failure; cannot estimate proportion of diseased, having rotted before digging.

4.—(Kintyre.) Campbelltown, Gigha, Kilcalmonell and Kilberry, Killean and Kilkenzie, Southend, and Saddell and Skipness. *Enumerator*, Peter Watson, Campbelltown.

Abstract of Report.—Grain secured in first-rate order, and generally of good quality, especially oats and beans. Turnips good; mangold excellent. Potatoes much diseased, but proportion cannot be estimated.

5.—(Islay.) Bowmore or Killarrow, Kilchoman, Kildalton, and Kilmeny. *Enumerator*, Archibald M'Donald, Ardnave, Bowmore.

Abstract of Report.—Grain secured early, and in good condition. Oats and rye above an average crop; bere an average; turnips below an average; potatoes a poor crop, and about one-fourth diseased.

6.—(Mull.) Kilfinichen and Kilmachewan, Kilmore and Kilninian, and Torosay and Pennygowan. *Enumerator*, D. A. M'Diarmid, Kilfinichen, Mull.

Abstract of Report.—Crops secured early, and in good condition; quality good. Potatoes diseased from one-half to one-third of whole crop.

7.—Coll. *Enumerator*, John Campbell, Cornaig, Coll.

Abstract of Report.—Grain secured in good condition, and of good quality.

8.—Tyree. *Enumerator*, Donald Campbell, Reef Cottage, Tyree.

Abstract of Report.—Crops secured well, but deficient in quantity.

9.—Jura and Colonsay. *Enumerator*, Neil M'Leod, Feolin, Jura.

Abstract of Report.—Cereals never secured in better order. Oats good. Bere under an average. Turnips half a crop. Potatoes a poor crop, and about one-fourth diseased.

10.—Morven, and Argyllshire portion of Ardnamurchan. *Enumerator*, John A. Sellar, Ardtornish, Morven.

Abstract of Report.—Oats secured in excellent condition. Turnips deficient in quantity and quality. Potatoes two-thirds diseased.

3.—County of Ayr.

District No. 1.—Ballantrae, Barr, Colmonell, Dailly, Girvan, Kirkmichael, Kirkoswald, Maybole, and Straiton. *Enumerator*, Alexander Ralston, Lagg, Ayr.

Abstract of Report.—Harvest generally favourable, and crops well secured. Wheat inferior in quality. Other cereals average crops. Turnips and mangold deficient in quantity. Potatoes much diseased; about one ton per acre fit for farina-mill, but considerable proportion rotten.

2.—Auchinleck, Ayr, Coylton, Dalrymple, Dalmellington, Muirkirk, New Cumnock, Old Cumnock, Ochiltree, and Stair. *Enumerator*, James Drennan, Holehouse, Ayr.

Abstract of Report.—Harvest tedious; but no loss sustained by exposure. Wheat an inferior crop; other cereals an average. Turnips and mangold deficient. Cannot estimate extent of disease in potatoes.

3.—Craigie, Dundonald, Galston, Mauchline, Monkton and Prestwick, Newton, Riccarton, St Quivox, Sorn, Symington, and Tarbolton. *Enumerator*, Thomas Reid, Monkton Mill, Ayrshire.

Abstract of Report.—Weather during harvest precarious, but by care and activity crops secured without loss. Cereals generally an average, but root-crops very deficient. Potatoes one-third diseased.

4.—Ardrossan, Beith, Dalry, West Kilbride, Kilbirnie, Kilwinning, Largs, and Stevenston. *Enumerator*, David Cuninghame, Chapelton, Ardrossan.

Abstract of Report.—Wheat, three-quarters well secured, and of good quality; remainder very inferior. Barley and rye average crops. Oats well secured; above average quantity, but rather light. Beans and pease inferior, and ill secured. Turnips and mangold deficient, but sound. Potatoes very inferior; one-half diseased.

5.—Dreghorn, Dunlop, Fenwick, Irvine, Kilmarnock, Kilmaurs, Loudon, and Stewarton. *Enumerator*, John Guthrie, Holms, Kilmarnock.

Abstract of Report.—Harvest late, but crops secured without injury. Cereals are thrashing well, but generally deficient in weight and quality, particularly wheat. Beans very deficient in quantity. Turnips and mangold much below average, particularly in undrained clay lands. Potatoes very bad; three-fourths diseased.

4.—County of Banff.

District No. 1.—Alvah, Banff, Bellie, Boyndie, Cullen, Fordyce, Forglen, Gamrie, Inverkeithny, Marnoch, Ordiquhill, and Rathven. *Enumerator*, George Williamson, Auldtown, Turriff.

Abstract of Report.—The cereals generally suffered from exposure, and are inferior in quality. It is estimated that wheat and oats were deteriorated 15 per cent, and barley 10 per cent. Potatoes an inferior crop, with about one-fourth diseased.

2.—Aberlour, Boharm, Botriphnie, Cabrach, Deskford, Grange, Inveravon, Keith, Kirkmichael, Mortlach, and Rothiemay. *Enumerator*, James Black, Knock, Keith.

Abstract of Report.—No part of the cereals secured before the rain. In the earlier parts of Rothiemay, Grange, Keith, and Aberlour, where the grain was partly cut when the weather broke, the deterioration is estimated at from 15 to 20 per cent; elsewhere at from 5 to 6 per cent. Potatoes one-fourth diseased.

5.—County of Berwick.

District No. 1.—Abbey St Bathans, Ayton, Buncle and Preston, Cockburnspath, Cranshaws, Coldingham, Chirnside, Edrom, Eyemouth, Foulden, Hutton, Ladykirk, Longformacus, Mordington, Swinton, and Whitsome. *Enumerator*, John Wilson, Edington Mains, Chirnside.

Abstract of Report.—Grain crops very bulky, and portion secured before the rains of excellent quality. A large proportion of the wheat which was exposed sprouted, and is unfit for food; much has already gone to the distilleries, at prices less by 4s. to 5s. per bushel than those of sound wheat. Oats exposed were also

seriously damaged. Barley suffered less. Beans were unripe during bad weather, and were ultimately well secured; they are an abundant crop, and promise to be of good quality. Damage by heat in stack unusually great this year. Deterioration and loss from exposure, &c., estimated as follows:—wheat one-quarter well secured, three-quarters deteriorated in value 40 per cent; barley one-half well secured, one-half deteriorated in value 25 per cent; oats one-quarter well secured, three-quarters deteriorated in value 33 per cent. Potatoes three-eighths diseased.

2.—Channelkirk, Coldstream, Dunse, Earlston, Eccles, Fogo and Polwarth, Gordon, Greenlaw, Hume, Langton, Lauder, Legerwood, Mertown, Nenthorn, and Westruther. *Enumerator*, Thomas Logan, Woodend, Dunse.

Abstract of Report.—Nearly the whole of the crops out when the weather broke. Wheat deteriorated to such an extent that one-third is estimated as unfit for food, and the remainder is of inferior quality. Barley and oats have also suffered, but not to so great an extent. Potatoes one-third diseased.

6.—County of Bute.

District No. 1.—(Bute.) Kingarth, North Bute, Rothesay, and Meikle and Little Cumbray. *Enumerator*, Samuel Girdwood, Little Kilmory, Rothesay.

Abstract of Report.—Harvest most propitious. Cereals secured in excellent condition, and of good quality. Potatoes one-third diseased.

2.—(Arran.) Kilmory, and Kilbride. *Enumerator*, James Allan, Clauchan, Arran.

Abstract of Report.—Cereals secured in good condition, and of good quality. Potatoes very inferior crop, and one-third diseased.

7.—County of Caithness.

District No. 1.—Bower, Latheron, Watten, and Wick. *Enumerator*, George Brown, Watten Mains, Wick.

Abstract of Report.—Cereals secured in good condition; a few stacks have heated. 2½ per cent will cover consequent damage. Wheat inferior; other cereals good, but oats light. Turnips generally superior, but finger-and-toe occasional. Potatoes—red varieties sound, regents and kidneys slightly diseased.

2.—Canisby, Dunnet, Halkirk, Olrig, Reay (in Caithness), and Thurso. *Enumerator*, Alexander Henderson, younger of Stempster, Thurso.

Abstract of Report.—Harvest operations unusually protracted, but little damage sustained. Wheat and barley are inferior. Oats fair, but with unusual proportion of light grain. Bere an average. Turnips good. Potatoes varying.

8.—County of Clackmannan.

Alloa, Clackmannan, Dollar, Logie, Tillicoultry, and Tulliallan (in Perth). *Enumerator*, Thomas Ritchie, Bowhouse, Alloa.

Abstract of Report.—Barley of average quality. Other cereals inferior which suffered from exposure. Wheat, one-third deteriorated 15 to 20 per cent. Barley, one-fifth deteriorated 10 to 15 per cent. Oats, three-fourths 14 to 20 per cent. Beans from 8 to 16 per cent. Turnips and mangold good. Potatoes, one-half diseased.

9.—County of Dumbarton.

Arrochar, Bonhill, Cardross, Cumbernauld, Dumbarton, Kilmaronock, East Kilpatrick, West Kilpatrick, Kirkintilloch, Luss, Rosneath, and Row. *Enumerator*, Lorne Campbell, Roseneath.

Abstract of Report.—Wheat and barley generally well secured, and of fair quality. Oats two-thirds well secured—one-third damaged 10 per cent in value.

Turnips—early sown, good—late sown, on damp land, very deficient. Potatoes above a half diseased.

10.—County of Dumfries.

District No. 1.—(Upper Annandale.) Applegarth, Dryfesdale, Hutton, Johnstone, Kirkpatrick-Juxta, Lochmaben, Moffat, St Mungo, Tundergarth, and Wamphray. *Enumerator*, John Graham, yr. of Shaw, Lockerbie.

Abstract of Report.—Cereals of average quality, and secured in good condition, except in some of the higher parishes; but, even there, loss was inconsiderable. Turnips good. Potatoes inferior, and one-third to one-half diseased.

2.—(Lower Annandale.) Annan, Cummertrees, Dalton, Dornock, Gretna, Hoddam, Kirkpatrick-Fleming, Middlebie, Mousewald, and Ruthwell. *Enumerator*, Bradshaw Barker, Wysebyhill, Ecclefechan.

Abstract of Report.—Cereals generally well secured, except in late and undrained districts. Wheat an average crop. Barley slightly damaged. In four parishes, where oats partially exposed, one-seventh damaged 40 per cent. Beans an average. Turnips small, with more than usual disease. Potatoes bulkier crop than 1855, but one-third diseased.

3.—(Upper Nithsdale.) Closeburn, Durrisdeer, Glencairn, Keir, Kirkconnell, Morton, Penpont, Sanquhar, and Tynron. *Enumerator*, James Grierson, Morton Mains, Thornhill.

Abstract of Report.—Cereals of average quality, little damaged by exposure, except in Sanquhar and Kirkconnell, where loss may have been one-tenth. Turnips an average. Potatoes inferior, and about one-tenth diseased.

4.—(Lower Nithsdale.) Caerlaverock, Dumfries, Dunscore, Holywood, Kirkmahoe, Kirkmichael, Tinwald, and Torthorwald. *Enumerator*, James W. Paterson, Pearmount, Dumfries.

Abstract of Report.—Cereals generally well secured, and of fair quality, but still soft, and below an average weight. Turnips deficient. Mangold small, and run to seed. Potatoes about one-fourth diseased, chiefly in the early varieties.

5.—(Eskdale.) Canonbie, Eskdalemuir, Ewes, Half-Morton, Langholm, and Westerkirk. *Enumerator*, James Church, Tower of Sark, Canonbie.

Abstract of Report.—Half of cereals secured in good condition, remainder deteriorated,—wheat 12½ per cent, barley 15 per cent, oats 25 per cent. Potatoes diseased nearly the half.

11.—County of Edinburgh.

District No. 1.—Mid-Calder, West-Calder, Corstorphine, Cramond, Currie, Kirknewton, South Leith, North Leith, and Ratho. *Enumerator*, Peter M'Lagan, yr. of Pumpherston, Mid-Calder.

Abstract of Report.—About one-third of cereals secured in good condition; remaining two-thirds deteriorated in value, from exposure, from 20 to 25 per cent. Potatoes two-thirds diseased.

2.—Colinton, Dalkeith, Duddingston, Glencorse, Inveresk, Lasswade, Liberton, Newton, and St Cuthberts. *Enumerator*, John Finnie, Swanston, Edinburgh.

Abstract of Report.—Except in Inveresk, where crops were generally better secured, only about one-fourth of the wheat and oats secured in good condition, and three-fourths deteriorated 20 per cent. Barley, three-fourths secured, and one-fourth deteriorated 14 per cent. Potatoes, one-half diseased.

3.—Borthwick, Carrington, Cockpen, Cranston, Crichton, Fala, Heriot, Newbattle, Penicuik, Temple, and Stow. *Enumerator*, James M'Lean, Braidwood, Penicuik.

Abstract of Report.—Cereals generally suffered from exposure. Loss on wheat in the field 20 per cent, and remainder damaged by sprouting and discoloration; on barley 6 per cent, with less damage otherwise, though discoloured; on oats 20 per cent, with remainder sprouted and damaged. This estimate is irrespective of injury from heating in the stack. Bere, beans, and pease but little damaged. Potatoes one-fifth diseased.

12.—County of Elgin.

Abernethy, Alves, Birnie, Cromdale, Dallas, Drainy, Duffus, Duthil, Dyke, Edinkillie, Elgin, Forres, Kinloss, Knockando, St Andrews-Lhanbride, New Spynie, Rafford, Rothes, Speymouth, and Urquhart. *Enumerator*, James Geddes, Orbliston, Fochabers.

Abstract of Report.—About 4 per cent only of the crops secured before the weather broke. In Abernethy, Cromdale, Dallas, and parts of Edinkillie and Knockando, all upland districts, the crop was secured in average condition in consequence of the lateness of the harvest. In the earlier districts the deterioration from exposure is estimated at 20 per cent on wheat, 10 per cent on barley, and 20 per cent on oats. Potatoes diseased from one-third to one-half of the crop.

13.—County of Fife.

District No. 1.—Beath, Carnock, Culross (in Perthshire), Dalgety, Dunfermline, Inverkeithing, Saline, and Torryburn. *Enumerator*, R. E. Beveridge, Urquhart, Dunfermline.

Abstract of Report.—Fully two-thirds of the cereals suffered from exposure. Deterioration is estimated in wheat at 12 per cent, on barley at 10 per cent, and on oats at 20 per cent. The varieties in weight are extraordinary, and the proportion of light grain great. One-half of potato crop unsound, and the disease still progressing.

2.—Abbotshall, Aberdour, Auchterderran, Auchtertool, Ballingry, Burntisland, Dysart, Kennoway, Kinghorn, Kinglassie, Kirkcaldy, Leslie, Markinch, Scoonie, and Wemyss. *Enumerator*, James B. Fernie of Kilmux, Kennoway.

Abstract of Report.—Crops generally exposed to weather. Wheat, one-fourth secured in good condition; three-fourths, of inferior quality, sprouted, and deteriorated in value 30 per cent. Barley, two-thirds secured in good condition; one-third deteriorated 15 per cent. Oats, one-third secured in good condition; two-thirds deteriorated 30 per cent. Beans and pease in good order. Potatoes nearly one-half diseased, and loss still going on.

3.—Abdie, Auchtermuchty, Balmerino, Ceres, Collessie, Creich, Cults, Cupar, Dairsie, Dunbog, Falkland, Flisk, Kettle, Kilmany, Logie, Monimail, Moonzie, Newburgh, and Strathmiglo. *Enumerator*, William Dingwall, Ramornie, Ladybank.

Abstract of Report.—Large proportion of cereals inferior in quality. Wheat, one-third secured in good condition; two-thirds deteriorated 33 per cent. Barley, one-third secured in good condition; two-thirds deteriorated 20 per cent. Oats, one-ninth secured in good condition; remainder deteriorated 25 per cent. Beans and pease generally deteriorated 5 per cent. Potatoes diseased nearly one-half.

4.—Anstruther (Easter and Wester), Cameron, Carnbee, Crail, Denino, Elie, Ferry-Port-on-Craig, Forgan, Kemback, Kilconquhar, Kilrenny, Kingsbarns, Largo, Leuchars, Newburn, Pittenweem, St Andrews, St Leonards, and St Monance. *Enumerator*, James Balfour, Milton, Leuchars.

Abstract of Report.—Quality of cereals secured early—an average. Wheat, one third secured in good condition; two-thirds deteriorated 30 per cent. Barley one-third secured in good condition; two-thirds deteriorated 15 per cent. Oats

one-thirtieth secured in good condition; remainder deteriorated 20 per cent. Rye, one-half secured in good condition; one-half injured 15 per cent. Beans and pease all exposed and injured 10 per cent.

14.—County of Forfar.

District No. 1.—Airlie, Arbirlot, Auchterhouse, Barry, Cortachy, Dundee, Eassie and Nevy, Glammis, Glenisla, Inverarity, Kettins, Kingoldrum, Kinettles, Kirriemuir, Liff and Benvie, Lintrathen, Lundie and Fowlis Easter, Mains and Strathmartin, Monifieth, Monikie, Murroes, Newtyle, Panbride, Ruthven, and Tealing. *Enumerator*, John Alexander, Mains of Glammis.

Abstract of Report.—Wheat, one-tenth secured in good condition; remainder deteriorated 40 per cent. Barley, one-sixth secured; remainder deteriorated 25 per cent. Oats, one-eighth secured; remainder deteriorated 20 per cent. Beans 5 per cent deteriorated. Potatoes one-half diseased.

2.—Aberlemno, Arbroath, Brechin, Caraldstone, Carmylie, Craig, Dun, Dunnichen, Edzell, Farnell, Fern, Forfar, Guthrie, Inverkeillor, Kinnell, Kirkden, Lethnot, Lochlee, Logie-Pert, Lunan, Marytoun, Menmuir, Montrose, Oathlaw, Rescobie, St Vigeans, Stracathro, and Tannadyce. *Enumerator*, Robert Hector, Kintrockat, Brechin.

Abstract of Report.—Quality of cereals generally inferior, owing to the discoloration, sprouting, and heating in stack. Wheat, one-twentieth secured in good condition; remainder deteriorated 30 per cent. Barley and Bere, one-twelfth secured in good condition; remainder deteriorated 25 per cent. Oats, one-sixteenth secured in good condition; remainder deteriorated 25 per cent. Beans and Pease, none secured in good condition, all deteriorated 10 per cent:-(this deterioration includes a quantity entirely lost in the field.) Potatoes one-third diseased.

15.—County of Haddington.

District No. 1.—Haddington, Gifford, Garvald, Bolton, and Morham. *Enumerator*, George Harvey, Whittingham Mains, Prestonkirk.

Abstract of Report.—In parish of Haddington about one-fifth of the cereals secured before the weather broke; in the other parishes not above one-twentieth. Wheat and oats suffered most, and were deteriorated about 30 per cent; barley about 15 per cent. Turnips an average crop. Potatoes one-half diseased.

2.—Humbie, Ormiston, Pencaitland, and Salton. *Enumerator*, Henry M. Davidson, Holyn Bank, Haddington.

Abstract of Report.—About one-eleventh of the cereals only secured before the weather broke, the remainder much deteriorated by exposure. The former is good in quality, the latter inferior. Potatoes one-half diseased.

3.—Gladsmuir, Prestonpans, and Tranent. *Enumerator*, David Wright, Southfield, Gladsmuir.

Abstract of Report.—One-third of the cereals secured in good condition, and of an average quality; two-thirds deteriorated, by exposure, 30 per cent. Beans and pease of average quality. The weight of grain given refers to the portion secured early. Potatoes diseased one-half.

4.—Aberlady, Athelstaneford, Dirleton, and North Berwick. *Enumerator*, George Hope, Fenton Barns, Drem.

Abstract of Report.—Two-fifths of wheat, three-fourths of barley, one-fourth of oats, secured in good condition, and of good quality; remainder deteriorated from 20 to 25 per cent in value. Potatoes one-half diseased.

5.—Prestonkirk, Stenton, Whitekirk, and Whittingham. *Enumerator*, Mathew Buist, Tynninghame, Prestonkirk.

Abstract of Report.—One-half of the cereals exposed to weather, and deteriorated in value from 25 to 30 per cent. The quality of the grain secured early is good. Potatoes diseased from one-third to one-half.

6.—Dunbar, Innerwick, Oldhamstocks, and Spott. *Enumerator*, P. H. Hume, Lawfield, Cockburnspath.

Abstract of Report.—Not above one-third of the cereals secured in good condition, and fully one-half deteriorated in value 50 per cent. Wheat bad. Barley indifferent. Oats very bad. Beans and pease fair. Turnips and mangold good. Potatoes diseased one-third.

16.—County of Inverness.

District No. 1.—Kilmorack, Kiltarlity, and Kirkhill. *Enumerator*, John Peter, Croyard, Beauly.

Abstract of Report.—Cereals are very inferior. Their deterioration from exposure is estimated at 20 per cent, and 10 per cent is unfit for the market. Potatoes diseased one-third.

2.—Urquhart and Glenmoriston. *Enumerator*, John Sinclair, Borlumbeg, Drumnadrochit.

Abstract of Report.—In the lower part of the district one-third of the cereals cut before the weather broke, and suffered from sprouting; the grain generally of an inferior character. In the higher districts the crops did not ripen properly, which will increase the proportion of inferior grain. Potatoes one-half diseased.

3.—Abertarff and Boleskine, Daviot, Dores, and Inverness and Bona. *Enumerator*, Hugh Fraser, Balloch, Inverness.

Abstract of Report.—Cereals all suffered from exposure. At the time the weather broke, about one-half had been cut in the lower part of the district, but little in the higher. The quality in both inferior; much sprouted in the low grounds, and ill-ripened in the high. There is therefore a large proportion of light grain, which has tended to reduce the averages. Disease in potatoes varied from one-half to three-fourths and four-fifths of the crop.

4.—Alvie, Kingussie, Insh, Laggan, and Rothiemurchus. *Enumerator*, James M'Pherson, Biallid, Kingussie.

Abstract of Report.—Crops secured in good condition, having suffered little or no deterioration from exposure. There is no unsound, but perhaps a larger proportion than ordinary of light grain. Potatoes diseased about one-eighth.

5.—Ardnamurchan (Inverness-shire part), Glenelg, Kilmallie (Inverness-shire part), and Kilmonivaig. *Enumerator*, James Bett, Strone, Fort-William.

Abstract of Report.—Crops secured in good condition, and of fair average quality. Potatoes diseased about one-fifth.

6.—(Skye.) Bracadale, Duirnish, Kilmuir, Portree and Rasay, Sleat, Snizort, and Strath. *Enumerator*, Donald M'Leod, Kingsburgh, Portree.

Abstract of Report.—Harvest early and favourable, and crops secured in excellent condition, and of good quality. Accounts of potato disease are so conflicting as to preclude an estimate.

7.—Harris and Bernera. *Enumerator*, Kenneth Macdonald, Scaristavore, Harris, Stornoway.

Abstract of Report.—Harvest favourable; crops well secured; quality good, except potatoes.

8.—North Uist. *Enumerator*, Alexander Macdonald, Balranald, Lochmaddy.

Abstract of Report.—Cereals about an average in respect of quality. Green crops deficient, particularly potatoes, which in some places are nearly a total failure.

9.—South Uist. *Enumerator*, Norman Macdonald, Nunton, Lochmaddy.

No Report.

10.—Barra. *Enumerator*, Dr M'Gillivray, Eoligary, Lochmaddy.

Abstract of Report.—Harvest favourable, and cereals of fair quality.

11.—Small Isles.

No Report.

17.—County of Kincardine.

Arbuthnot, Banchory-Devenick, Banchory-Ternan, Benholm, Bervie, Dunottar, Durris, Fettercairn, Fetteresso, Fordoun, Garvock, Glenbervie, Kinneff, Laurencekirk, Maryculter, Marykirk, Nigg, St Cyrus, and Strachan. *Enumerator*, James Farquharson, Auchinblae.

Abstract of Report.—Wheat one-tenth well secured, nine-tenths deteriorated 33 per cent. Barley one-fourth well secured, three-fourths deteriorated 14 per cent. Oats nearly all exposed, and deteriorated 17 per cent. Rye one-fifth well secured, four-fifths deteriorated 16 per cent. Bere one-fourth well secured, three-fourths deteriorated 14 per cent. Beans and pease little injured, but not all secured on 15th November. Turnips and mangold good. Potatoes one-third diseased.

18.—County of Kinross.

Arngask, Cleish, Fossoway, Kinross, Orwell, and Portmoak. *Enumerator*, Andrew Douie, Blair-Adam.

Abstract of Report.—Cereals promised to be much above an average, more particularly oats, but all suffered from exposure. About one-tenth of the wheat, two-thirds of the barley, but almost no oats, were secured in fair condition. The remainder of the wheat and barley, and nearly the whole oat-crop, lost about one-third from sprout and handling, and what is marketable is deteriorated in quality and weight. Turnips an average crop in dry, but very inferior in wet soils. Potatoes about one-half unsound, and disease progressing.

19.—Stewartry of Kirkcudbright.

District No. 1.—Colvend, Irongray, Kirkbean, Kirkpatrick-Durham, Kirkgunzeon, Lochrutton, New Abbey, Terregles, Troqueer, and Urr. *Enumerator*, Thomas Lawrie, Terregleston, Dumfries.

Abstract of Report.—Weather during harvest was uncertain and precarious, but the grain was mostly secured in good condition, and is of fair average quality. Potatoes one-third diseased.

2.—Buittle, Crossmichael, Kelton, Kirkcudbright, Parton, and Rerrick. *Enumerator*, Robert M'Knight of Barlochan, Castle Douglas.

Abstract of Report.—From four-fifths to five-sixths of cereals secured in very good condition; remainder was much deteriorated by exposure. Wheat and oats are below an average. Potatoes two-fifths diseased.

3.—Anworth, Balmaghie, Borgue, Girthon, Kirkmabreck, Minnigaff, Tongland, and Twynholm. *Enumerator*, Walter M'Culloch of Kirkclaugh, Gatehouse.

Abstract of Report.—Cereals secured about the usual period, in good condition, and of good quality. Turnips and mangold good. Potatoes—one-third of early, and one-sixth of late varieties diseased.

4.—Balmaclellan, Carsphairn, Dalry and Kells. *Enumerator*, James Barbour of Bogue, Castle Douglas.

Abstract of Report.—Crops secured in good condition, and of excellent quality. Potatoes a variable but inferior crop, and one-third diseased.

20.—County of Lanark.

District No. 1.—Avondale, Barony, Blantyre, Bothwell, Cadder, Cambuslang, Cambusnethan, Carmunnock, Dalserf, Dalziel, Glasgow, Glassford, Govan, Hamilton, East-Kilbride, New Monkland, Old Monkland, Rutherglen, Shotts, and Stonehouse. *Enumerator*, William Forrest, of Treesbanks, Allanton, Hamilton.

Abstract of Report.—One-third of the cereals secured in good condition; two-thirds were stacked rather damp. Potatoes diseased fully one-third.

2.—Biggar, Carluke, Carmichael, Carnwath, Carstairs, Covington, Crawford, Crawfordjohn, Culter, Dolphinton, Douglas, Dunsyre, Lanark, Lesmahagow, West-Liberton, Pittenain, Symington, Walston, Wandell and Lamington, and Wiston and Roberton. *Enumerator*, James Brown, Liberton Mains, Lanark.

Abstract of Report.—No part of crop secured before weather broke. About one-half then cut, which suffered much from sprout, and from heat in stack. Uncut portion lost by shaking, but in better condition, and yields a finer sample. None of the crop well secured, and general deterioration great, though difficult to estimate, from varieties of condition arising from different causes.

21.—County of Linlithgow.

Abercorn, Bathgate, Borrowstowness, Carriden, Dalmeny, Ecclesmachan, Kirkliston, Linlithgow, Livingston, Torphichen, Uphall, and Whitburn. *Enumerator*, Robert J. Thomson, Hangingside, Linlithgow.

Abstract of Report.—Wheat, one-tenth secured in good condition; nine-tenths deteriorated 33 per cent. Barley, one-half secured in good condition, one-half deteriorated 12 per cent. Oats nearly all deteriorated 25 per cent. Beans and pease all exposed, but little damaged. Potatoes diseased one-half.

22.—County of Nairn.

Ardclach, Auldearn, Ardersier, Cawdor, Croy, Nairn, Moy, and Petty. *Enumerator*, James Mitchell, Mills of Nairn, Nairn.

Abstract of Report.—Very little grain secured before the weather broke. Wheat considerably sprouted. Barley discoloured, but sound. Oats 5 per cent deteriorated. Rye and bere tolerable. Beans and pease soft. Turnips excellent; mangold good. Potatoes one-half diseased.

23.—County of Orkney.

District No. 1.—(Mainland.) Birsay and Harray, Evie and Rendal, Firth and Stennis, Orphir, Kirkwall or St Ola, Holm, St Andrew and Deerness, Sandwick, and Stromness. *Enumerators*, George Folsetter, Evie; George Frisken, Mill of Kirbuston, Orphir; Robert Armit, Kirkwall; and William Watt, Skaill.

Abstract of Report.—Crops generally a fair average, but deficient in weight, in consequence of low temperature and want of sunshine during summer. Disease in potatoes generally confined to the finer varieties; Orkney reds safe, and a good crop.

District No. 2.—(North Isles.) Cross and Burness, Lady in Sanday, North Ronaldshay, Eday and Phara, Shapinshay, Stronsay, Rousay and Egilshay, Westray, and Papa Westray. *Enumerators*, Jerome Dennison, West Brough; George Davidson, Greentoft; James Fullarton, Strathor; John Forbes, Stronsay; George Learmonth, Westness; and Thomas Traill of Holland.

Abstract of Report.—Crops, though late, secured without injury, and nearly an

average in quality, but deficient in weight in consequence of low temperature in summer. Potatoes little diseased.

District No. 3.—(South Isles.) Hoy and Graemsay, Walls, &c., South Ronaldshay, and Flotta. *Enumerators*, William Banks, Walls; and William Cromarty, South Ronaldshay.

Abstract of Report.—Crops, though late, secured in good order. Oats lighter than last year. Bere of good quality. Potatoes and turnips good.

ZETLAND.

The Islands of Zetland.

Abstract of Report.—Harvest later than usual, but weather fine. Oats an average in bulk, but deficient in weight. Turnips in general good. Potatoes a half crop, and much diseased.

24.—County of Peebles.

Broughton, Drumelzier, Eddlestone, Innerleithen, Kirkurd, Linton, Lyne and Megget, Manor, Newlands, Peebles, Skirling, Stobo, Traquair, and Tweedsmuir. *Enumerator*, James Murray, Drochil Castle, Noblehouse.

Abstract of Report.—Barley mostly secured in good condition, but not of fine quality. Oats deteriorated by exposure 12 per cent, and inferior in quality. Potatoes one-third diseased.

25.—County of Perth.

District No. 1.—Abernyte, Errol, Inchture, Kilspindie, Kinfauns, Kinnaird, Longforgan, and St Madoes. *Enumerator*, James Young, Cairney Mill, Perth.

Abstract of Report.—Much of the grain so sprouted as to be fit only for distillation. Estimated deterioration from exposure—wheat 28 per cent; barley 18 per cent; oats 23 per cent. Potatoes three-fourths diseased; unsound portion generally converted into flour, and brings at the mills nearly half price.

2.—Abernethy, Auchterarder, Dron, Dumbarney, Dunning, Forteviot, Forgandenny, Glendovan, Muckhart, and Muthill. *Enumerator*, Thomas W. Lorimer, Belkie, Auchterarder.

Abstract of Report.—Cereals of all kinds, especially oats and wheat, promised to be far above an average, but all suffered from exposure. Fully one-third of the wheat and barley, one-half of the oats, and almost all the beans and pease, were unsecured by the end of October, and were deteriorated by lodging and shaking, by wet in stook and heat in stack, the latter cause of damage having operated also on what had been previously secured. One-third of wheat, mostly autumn-sown, pretty good; two-thirds deteriorated, raw and light. Barley much lodged, and inferior in quality. Oats well filled, but discoloured and damaged by rain. Beans and pease heated in stack. Turnips very good. Potatoes diseased about one-half.

3.—Caputh, Cargill, Collace, Kinnoull, Lethendy, Scone, and St Martins. *Enumerator*, John M. Matthew, Colin, Perth.

Abstract of Report.—Wheat one-fourth secured in good condition, three-fourths deteriorated 50 per cent. Barley two-thirds secured in good condition, one-third deteriorated 33 per cent. Oats one-half secured in good condition, one-half deteriorated 33 per cent. Beans and pease all outstanding: beans suffered little; pease lost about one-half. Potatoes diseased about one-half.

4.—Auchtergaven, Kinclaven, Moneydie and Logiealmond, Methven, Perth, Redgorton and Stanley, Rhind, and Tibbermuir. *Enumerator*, Thomas Wylie of Airliewight, Bankfoot, Perth.

Abstract of Report.—Weight and quality of cereals vary, so as to make an estimate difficult, but generally they are lighter than for many years back.

Wheat was bulky, and yields fairly, but very deficient in weight, and injured by sprouting from 12 to 20 per cent. Barley is of better quality. Oats were a bulky crop, but much deteriorated, being light, and deteriorated by sprouting about 17 per cent. Early-sown turnips an average; late-sown inferior. Potatoes a heavy crop, but much diseased; in low heavy land, from one-half to nearly the whole crop gone; in lighter soil, three-fourths safe, but giving way in the pits.

5.—Aberdalgie, Comrie, Crieff, Fowlis Wester, Gask, Madderty, Monzie, Monzievaird, and Trinity-Gask. *Enumerator*, Thomas Ross, Bachilton, Perth.

Abstract of Report.—Harvest the most unfavourable experienced for many years; and great damage has been sustained, not only on the field, but in the stack-yard, from heating, and by handling and rebuilding stacks. Deterioration estimated as follows:—Wheat one-fifth well secured, remainder deteriorated from 35 to 40 per cent. Barley secured in better condition than any other crop, and not deteriorated above 5 or 6 per cent. Oats one-tenth secured in good condition, remainder deteriorated 50 per cent;—(this crop has suffered particularly from sprouting and heat in stack.) Beans and pease generally little damaged. Potatoes one-half diseased.

6.—Aberfoyle, Balquhidder, Blackford, Callander, Dunblane, Kilmadock, Kincardine, and Port-of-Monteith. *Enumerator*, Robert Patterson, Offers, Stirling.

Abstract of Report.—Wheat and barley generally secured in good condition, and of good quality. Oats one-fourth secured in good condition, three-fourths deteriorated about 20 per cent. Beans generally well secured. Potatoes one-third diseased.

7.—Dull, Fortingall, Kenmore, Killin, Logierait, and Weem. *Enumerator*, F. N. Menzies, Tirinie, Aberfeldy.

Abstract of Report.—One-third of cereals secured in good condition, two-thirds deteriorated, and of that proportion one-fifth lost. Wheat inferior. Barley and bere discoloured. Oats, beans, and pease an average. Turnips variable. Potatoes diseased one-fifth.

8.—Blair-Athole, Dunkeld, Little Dunkeld, and Moulin. *Enumerator*, Alexander Conacher, Mains of Pitlochrie, Pitlochrie.

Abstract of Report.—General deterioration to cereals from exposure and being badly secured, 25 per cent, with great differences in weight, and an unusual proportion of light grains. Potatoes about one-third diseased.

9.—Alyth, Bendochy, Blairgowrie, Cluny, Coupar-Angus, Kinloch, Kirkmichael, Meigle, and Rattray. *Enumerator*, Robert Geekie, Rosemount, Blairgowrie.

Abstract of Report.—Deterioration estimated at 40 per cent on wheat, 25 per cent on barley, and 20 per cent on oats. Potatoes one-half diseased.

26.—County of Renfrew.

District No 1.—Cathcart, Eaglesham, Mearns, and Neilston. *Enumerator* Arthur Mather, Netherplace, Newton Mearns.

Abstract of Report.—Harvest favourable, and crops well secured; quality an average. Potatoes two-fifths diseased.

2.—Eastwood, Paisley and Abbey, and Renfrew. *Enumerator*, John Colquhoun, Corkerhill, Pollockshaws.

Abstract of Report.—Crops secured without much injury. Potatoes one-third diseased.

3.—Erskine, Houston, Inchinnan, Kilbarchan, and Lochwinnoch. *Enumerator*, Alexander Wilson, Forehouse, Kilbarchan.

Abstract of Report.—Lateness of harvest and weather affected quality of crops. Turnips are deficient. Potatoes lifted generally for early sale, before disease appeared.

4.—Greenock, Innerkip, Kilmalcolm, and Port-Glasgow. *Enumerator*, James Foster King, Easter Longhaugh, Bishopton.

Abstract of Report.—Crops well secured, except in high district of Kilmalcolm. Wheat is inferior. Oats—the staple grain of the district—rather deficient, average having been reduced by effects of weather in Kilmalcolm, where the comparative breadth was large. Green crops very deficient. Potatoes not above one-fourth diseased, except in Innerkip, where one-half unsound.

27.—County of Ross and Cromarty.

District No. 1.—(Easter Ross.) Edderton, Fearn, Kilmuir, Kincardine, Logie Easter, Nigg, Rosskeen, Tain, and Tarbert. *Enumerator*, Crawford Ross, Cadboll, Tain.

Abstract of Report.—But little of the crop secured before the rains, and even that portion damaged by heat in stack; general deterioration in value from 12 to 14 per cent. Grain would generally turn out well if favoured with frosty weather, except the wheat, which, in some of the best land, suffered from mildew. Weights per bushel are only given as an approximation. Variation is this year so great as to impede an estimate. Potatoes diseased about one-half.

2.—(Wester Ross.) Alness, Avoch, Contin, Cromarty, Dingwall, Fodderty, Killearnan, Kiltearn, Knockbain, Resolis, Rosemarkie, Urquhart, and Urray. *Enumerator*, William Murray, Kilcoy, Dingwall.

Abstract of Report.—About one-third of the crop secured before the weather broke. Wheat was imperfectly ripened from want of sunshine, and what was exposed suffered much deterioration from sprouting and discoloration, and is very deficient in weight. Barley and oats less sprouted, but discoloured and light.

3.—Gairloch. *Enumerator*, Charles Robertson, Auchtercairn, Gairloch.

Abstract of Report.—Crops secured without injury, and of good quality. Potatoes diseased nearly one-half.

4.—Lochbroom. *Enumerator*, David Mundell, Auchendrean, Lochbroom.

Abstract of Report.—Crops secured without injury, and of good quality. Potatoes one-third diseased.

5.—Applecross, Glenshiel, Kintail, Lochalsh, and Lochcarron. *Enumerator*, David Logan, Auchtertyre, Lochalsh.

Abstract of Report.—Crops secured without injury, and of good quality. Potatoes one-eighth diseased.

6.—(Lewes.) Barvas, Lochs, Stornoway, and Uig. *Enumerator*, Murdoch M'Aulay, Lynshader, Stornoway.

Abstract of Report.—Crop secured without injury, and of good quality. Potatoes much diseased.

28.—County of Roxburgh.

District No. 1.—Ednam, Kelso, Smailholm, Sprouston, and Stitchell. *Enumerator*, John Dudgeon, Spylaw, Kelso.

Abstract of Report.—Quality of crop varies. Proportion well secured is of average quality. What was exposed is very inferior. Deterioration estimated as follows:—Wheat one-fifth well secured, four-fifths deteriorated 35 per cent; barley four-fifths well secured, one-fifth deteriorated 20 per cent; oats one-fifth well secured, four-fifths deteriorated 15 per cent. The weights given in Table VI. refer to crop secured before weather broke. Potatoes one-third diseased.

2.—Hownam, Linton, Morebattle, and Yetholm. *Enumerator*, Adam B. Boyd of Cherrytrees, Kelso.

Abstract of Report.—Not more than one-twelfth of the crops secured before the rains. Remainder was very much deteriorated by sprouting, loss of colour, &c.; but damage cannot be estimated. The weights in table refer to crops secured before weather broke. Potatoes one-third diseased.

3.—Crailing, Eckford, Makerstoun, and Roxburgh. *Enumerator*, James Roberton, Ladyrig, Kelso.

Abstract of Report.—Deterioration from exposure is estimated at—Wheat one-fourth well secured, three-fourths deteriorated 30 to 35 per cent; barley three-fourths well secured, one-fourth deteriorated 10 per cent; oats one-third well secured, two-thirds deteriorated 20 per cent; rye none well secured, all deteriorated 20 per cent; beans none well secured, all deteriorated 10 per cent. Quality of crops well secured is good, and weights given in the table refer exclusively to that portion. Potatoes nearly one-half diseased.

4.—Bedrule, Hobkirk, Jedburgh, Oxnam, and Southdean. *Enumerator*, John Ord of Muirhouselaw, Nisbet, Kelso.

Abstract of Report.—Most disastrous harvest in recollection. Three-fourths of the wheat, one-half of the barley, nine-tenths of the oats, and all the beans and pease, exposed to weather; and deterioration in value on the whole crop will not be less than 35 per cent on wheat, 10 per cent on barley, and 23 per cent on oats. Potatoes very inferior, and one-half diseased.

5.—Ancrum, Bowden, Lilliesleaf, Maxton, Melrose, Minto, and St Boswells. *Enumerator*, Nicol Milne of Faldonside, Melrose.

Abstract of Report.—About one-twelfth of the cereals secured in good condition, and of good quality. Remainder suffered seriously from exposure, and is very deficient in quantity and quality, with an unusual proportion of light grain. The average of deterioration in value estimated at from 35 to 40 per cent. Beans harvested in tolerable order, and a good crop. Turnips fully an average. Potatoes an average in bulk, but two-thirds diseased.

6.—Ashkirk, Cavers, Hawick, Kirkton, Roberton, and Wilton. *Enumerator*, Daniel Mather, Hallrule, Bonchester Bridge.

Abstract of Report.—About one-twentieth of the wheat and oats, and one-fifth of the barley, secured in good condition. Deterioration to remainder from exposure to weather and heat in stack estimated at 30 per cent. Beans tolerably well harvested. Potatoes one-half diseased.

7.—Castleton. *Enumerator*, John Jardine, Arkleton, Langholm.

Abstract of Report.—Crops secured without much injury. About one-third was exposed and damaged, but not to a great extent. Turnips are deficient. Potatoes one-half diseased.

29.—County of Selkirk.

Ettrick, Galashiels, Kirkhope, Selkirk, and Yarrow. *Enumerator*, John Anderson, Muirhouse, Stow.

Abstract of Report.—About one-eighth of the cereals secured in good order, and of good quality. The remainder much deteriorated by exposure; but it is difficult to estimate damage, as it was frequently greater in the stack than in the stook. Potatoes diseased one-half.

30.—County of Stirling.

District No. 1.—Airth, Alva, Bothkennar, Denny, Dunipace, Falkirk, Gargunnock, Larbert, Lecropt, Muiravonside, Polmont, St Ninians, Slamannan, and Stirling. *Enumerator*, William Forrester, Stewarthall, Stirling.

Abstract of Report.—Wheat, two-thirds well secured; one-third deteriorated 25 per cent. Oats, one-third well secured; two-thirds deteriorated 40 per cent. Barley little damaged. Beans deteriorated 10 per cent. Potatoes about two-fifths unsound, and disease still progressing.

2.—Baldernock, Balfron, Buchanan, Campsie, Drymen, Fintry, Killearn, Kilsyth, Kippen, and Strathblane. *Enumerator*, James Horne, New Mills, Campsie.

Abstract of Report.—Crops pretty well secured. Potatoes about one-third diseased; value of unsound nearly one-half of that of good.

31.—County of Sutherland.

District No. 1.—Farr, Tongue, Easter portion of Durness and Reay (in Sutherland). *Enumerator*, Alexander Clarke, Eriboll, Tongue.

Abstract of Report.—Crops generally secured in good condition. Potatoes, on an average, about one-twentieth diseased.

2.—Assynt, Edderachillis, and Western portion of Durness. *Enumerator*, Evander M'Iver, Scourie.

Abstract of Report.—Cereals promised to be above an average, but suffered from bad weather in September, and there is consequently a considerable proportion of damaged and light grain. Turnips were checked by wet in July. Potatoes about one-third unsound when dug, and disease still progressing in pit.

3.—Dornoch, Creich, Lairg, and Rogart. *Enumerator*, Robert B. Sangster, Golspie.

Abstract of Report.—Crops about three weeks later than usual in being secured, but not much injured. An average in point of quality. Any damage observable principally caused by heating in stack. Potatoes about one-half diseased.

4.—Clyne, Golspie, Kildonan, and Loth. *Enumerator*, Charles Hood, Inverbrora, Golspie.

Abstract of Report.—Crops generally well secured, but below average weight. Potatoes in some places about one-third diseased.

32.—County of Wigtown.

District No. 1.—(Machars.) Glasserton, Kirkinner, Kirkcowan, Mochrum, Penninghame, Sorby, Whithorn, and Wigtown. *Enumerator*, Alexander Aitken, Bladnoch, Wigtown.

Abstract of Report.—Crops secured without difficulty, and undamaged. Wheat and barley inferior. Oats above an average. Rye and bere much below it. Turnips and mangold an average. Potatoes one-third diseased.

2.—(Rhinns.) Inch, Kirkcolm, Kirkmaiden, Leswalt, Old Luce, New Luce, Portpatrick, and Stoneykirk. *Enumerator*, John Crawford, Glenhead, Stranraer.

Abstract of Report.—Crops secured without difficulty, or more than ordinary damage. Potatoes above one-half diseased.

APPENDIX.—STOCK.

COUNTIES.	HORSES. 1. Horses for Agricultural purposes above three years old.		2. Horses for Agricultural purposes under three years old.		3. All other Horses.		Total Horses.		CATTLE. Milk Cows.		Other Cattle.		Calves.		Total Cattle.		SHEEP. Sheep of all Ages for Breeding.		Sheep of all Ages for Feeding.		Lambs.		Total Sheep.		Swine.		Total Stock.		COUNTIES.
	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	1856.	1855.	
1. Aberdeen . .	16,718	16,203	3,631	3,362	2,551	2,709	22,900	22,274	36,222	34,869	74,344	73,995	31,223	31,817	141,789	140,681	36,787	38,109	47,393	43,230	28,504	28,060	112,684	109,399	9,631	8,673	287,004	281,027	Aberdeen . . 1.
2. Argyll . .	3,876	3,829	1,787	1,790	1,049	893	6,712	6,512	18,651	18,796	28,306	28,590	11,694	12,992	59,651	60,378	418,997	412,934	155,671	151,641	266,061	249,454	840,729	814,029	2,834	3,458	909,926	884,377	Argyll . . 2.
3. Ayr . . .	7,003	6,804	1,924	1,812	945	1,086	9,872	9,702	38,670	39,286	29,745	28,809	14,276	15,913	82,691	84,008	131,980	123,525	28,509	33,444	98,554	88,404	259,043	245,373	11,442	12,483	363,048	351,566	Ayr . . . 3.
4. Banff . .	4,487	4,405	1,213	1,025	714	705	6,414	6,135	8,809	8,512	16,735	17,174	8,078	7,947	33,622	33,633	16,680	16,318	8,847	9,694	12,422	11,729	37,949	37,741	3,253	2,987	81,238	80,496	Banff . . 4.
5. Berwick . .	4,055	4,182	1,227	1,100	862	990	6,144	6,272	3,800	3,911	9,194	9,569	4,023	4,213	17,017	17,693	88,192	91,300	58,194	54,448	90,455	94,377	236,841	240,125	4,275	4,290	264,277	268,380	Berwick . . 5.
6. { Bute . .	390	390	230	208	32	38	652	636	1,541	1,592	1,875	1,844	920	964	4,336	4,400	4,497	3,873	2,105	2,023	3,618	3,018	10,220	8,914	373	426	15,581	14,376	Bute . . } 6.
{ Arran . . .	296	299	66	64	30	26	392	389	1,175	1,213	1,337	1,142	534	660	3,046	3,015	14,205	12,925	3,996	3,531	9,928	9,174	28,129	25,630	291	360	31,858	29,394	Arran . . }
7. Caithness . .	2,080	2,004	502	471	324	314	2,906	2,789	4,188	3,908	7,897	7,013	3,609	3,738	15,694	14,659	30,329	29,744	20,166	19,093	23,363	21,610	73,858	70,447	1,220	1,149	93,678	89,044	Caithness . 7.
8. Clackmannan .	793	721	196	205	151	186	1,140	1,112	1,114	1,059	2,879	2,704	829	868	4,822	4,631	7,082	6,896	3,288	3,890	6,462	4,965	16,832	15,751	912	998	23,706	22,492	Clackmannan . 8.
9. Dumbarton .	1,349	1,318	504	549	302	319	2,155	2,186	5,274	5,110	5,686	5,745	2,079	2,289	13,039	13,144	30,218	27,322	8,898	12,645	22,662	21,075	61,778	61,042	844	1,042	77,816	77,414	Dumbarton . 9.
10. Dumfries . .	5,277	5,304	1,818	1,795	1,306	1,317	8,401	8,416	13,736	14,025	24,670	24,217	8,777	9,613	47,183	47,855	243,783	241,505	38,666	37,854	186,023	178,631	468,472	457,990	13,101	14,374	537,157	528,635	Dumfries . . 10.
11. Edinburgh .	3,445	3,390	692	674	857	938	4,994	5,002	5,255	5,352	8,351	8,801	2,472	2,749	16,078	16,902	64,428	66,628	26,828	26,123	52,214	54,792	143,470	147,543	5,266	5,225	169,808	174,672	Edinburgh . 11.
12. Elgin . .	3,537	3,526	785	720	528	545	4,850	4,791	6,074	5,964	11,523	11,162	5,068	5,303	22,665	22,429	27,756	28,726	11,551	14,171	20,433	20,856	59,740	63,753	3,727	4,074	90,982	95,047	Elgin . . 12.
13. Fife . . .	8,419	8,224	2,358	2,321	1,471	1,496	12,248	12,041	8,819	8,739	23,869	23,845	7,923	8,455	40,611	41,039	12,263	12,708	32,839	35,630	12,204	12,778	57,306	61,116	8,734	8,863	118,899	123,059	Fife . . . 13.
14. Forfar . .	7,491	7,447	1,806	1,750	1,206	1,220	10,503	10,417	12,299	12,266	26,585	27,410	10,665	11,232	49,549	50,908	27,336	28,989	47,433	50,059	22,853	22,171	97,622	101,219	6,247	6,383	163,921	168,927	Forfar . . 14.
15. Haddington .	3,353	3,266	570	518	749	697	4,672	4,481	2,086	2,069	6,399	5,508	1,437	1,627	9,922	9,204	29,347	29,003	32,324	29,447	32,453	28,403	94,124	86,853	4,923	4,676	113,641	105,214	Haddington . 15.
16. Inverness . .	2,404	2,330	671	634	570	521	3,645	3,485	8,175	8,301	9,951	9,758	5,452	6,002	23,578	24,061	292,887	285,919	127,541	143,156	167,277	138,619	587,705	567,694	1,474	1,667	616,402	596,907	Inverness . . 16.
17. Kincardine .	3,065	3,177	603	647	538	554	4,206	4,378	6,568	6,831	13,912	13,940	5,969	6,653	26,449	27,424	7,559	8,987	14,522	12,736	5,813	5,394	27,894	27,117	2,850	2,705	61,399	61,624	Kincardine . 17.
18. Kinross . .	953	1,039	485	522	131	138	1,569	1,699	1,595	1,599	4,611	5,002	2,082	2,023	8,288	8,624	7,763	6,869	10,144	9,398	7,903	6,720	25,810	22,987	869	948	36,536	34,258	Kinross . . 18.
19. Kirkcudbright .	3,747	3,745	1,443	1,466	793	862	5,983	6,073	9,107	9,206	24,012	24,434	6,731	7,118	39,850	40,758	137,025	134,786	43,124	44,345	111,754	113,517	291,903	292,648	6,433	7,352	344,169	346,731	Kirkcudbright . 19.
20. Lanark . .	5,765	5,704	1,506	1,336	1,399	1,425	8,670	8,465	31,309	30,186	20,740	20,386	9,373	10,129	61,422	60,701	89,859	86,291	20,313	21,135	66,817	69,193	176,989	176,619	6,998	7,666	254,079	253,451	Lanark . . 20.
21. Linlithgow .	1,659	1,587	467	434	452	313	2,578	2,334	3,446	3,434	6,103	5,840	1,797	1,975	11,346	11,249	4,471	2,861	7,229	8,755	4,813	4,029	16,513	15,645	1,494	1,524	31,931	30,752	Linlithgow . 21.
22. Nairn . .	1,378	1,410	312	289	155	127	1,845	1,826	2,392	2,275	4,500	4,137	1,851	1,892	8,743	8,304	17,998	21,316	6,982	6,914	10,710	10,257	35,690	38,487	1,103	1,489	47,381	50,106	Nairn . . 22.
23. { Orkney . .	1,373	1,314	425	400	165	185	1,963	1,899	2,621	2,538	3,972	3,417	2,080	2,173	8,673	8,128	4,822	5,083	1,816	1,414	4,458	4,318	11,096	10,815	1,152	1,337	22,884	22,179	Orkney . . } 23.
{ Zetland . .	73	74	22	9	401	465	496	548	303	298	789	780	185	182	1,277	1,260	3,142	3,318	954	843	2,109	1,684	6,205	5,845	52	50	8,030	7,703	Zetland . . }
24. Peebles . .	985	975	256	238	206	199	1,447	1,412	2,502	2,581	3,258	3,037	1,721	1,736	7,481	7,354	91,570	89,708	20,648	21,470	65,949	61,533	178,167	172,711	1,216	1,215	188,311	182,692	Peebles . . 24.
25. Perth . .	11,069	10,863	2,905	2,844	1,973	1,879	15,947	15,586	22,400	22,199	40,130	40,739	18,661	20,032	81,191	82,970	247,640	248,927	134,762	125,455	176,791	170,465	559,193	544,847	8,408	9,039	664,739	652,442	Perth . . 25.
26. Renfrew . .	2,275	2,272	681	744	521	607	3,477	3,623	11,414	11,621	7,762	8,297	3,177	3,595	22,353	23,513	9,672	10,515	5,343	6,139	9,046	9,196	24,061	25,850	1,446	1,808	51,337	54,794	Renfrew . . 26.
27. Ross & Cromarty	3,250	3,173	759	723	537	518	4,546	4,414	5,165	5,008	8,117	7,174	3,691	4,008	16,973	16,190	133,536	143,859	94,264	78,715	85,109	65,441	312,909	288,015	3,836	4,557	338,264	313,176	Ross & Cromarty 27.
28. Roxburgh . .	3,661	3,710	685	752	1,094	1,008	5,450	5,470	4,401	4,462	8,974	9,461	3,721	4,008	17,096	17,931	230,623	232,559	40,117	40,010	177,955	176,231	448,695	448,800	3,917	4,271	475,158	476,472	Roxburgh . 28.
29. Selkirk . .	394	397	98	71	138	122	630	590	729	697	1,164	1,012	430	444	2,323	2,153	78,663	79,135	3,060	3,577	57,747	52,396	139,470	135,108	357	322	142,780	138,173	Selkirk . . 29.
30. Stirling . .	3,640	3,525	1,146	1,106	556	648	5,342	5,279	8,524	8,721	14,673	14,533	5,333	5,858	28,530	29,112	37,313	42,909	15,096	12,919	30,137	29,685	82,546	85,513	2,348	2,488	118,766	122,392	Stirling . . 30.
31. Sutherland .	551	570	119	123	198	221	868	914	1,074	1,138	2,057	1,849	524	655	3,655	3,642	95,794	91,443	61,734	61,275	51,125	47,835	208,653	200,553	405	550	213,581	205,659	Sutherland . 31.
32. Wigtown . .	4,156	4,032	1,482	1,308	598	668	6,236	6,079	10,522	10,697	18,264	17,985	7,318	8,181	36,104	36,863	40,084	42,960	12,070	13,342	32,110	32,419	84,264	88,721	5,493	6,001	132,097	137,664	Wigtown . . 32.
	122,967	121,190	33,384	32,100	23,502	23,939	179,853	177,229	299,960	298,463	473,384	469,309	193,703	207,044	967,047	974,816	2,714,301	2,707,950	1,146,427	1,138,521	1,955,832	1,848,429	5,816,560	5,694,900	126,924	134,350	7,090,384	6,981,295	

PROCEEDINGS IN THE LABORATORY.

By Professor Anderson, Chemist to the Society.

COMPOSITION OF SOME FEEDING SUBSTANCES.

Madia sativa.—This plant has been extensively cultivated abroad for the sake of its oleaginous seeds, from which an oil is expressed; and both the seeds and cake obtained from them have been employed as cattle-food, though not to any extent in this country: nor has the plant itself been cultivated in Britain, although the climate appears not to be unfavourable to it. An attempt is about to be made to raise it in Scotland; and as a preliminary, I have analysed the seeds for the purpose of comparing their feeding value with that of linseed; and the results fill a gap in the chemistry of feeding substances, as I believe they have not hitherto been analysed in this point of view. An analysis of the ash has already been made, and is quoted by Professor Johnston in his *Lectures*, and in most treatises on agricultural chemistry. The following analysis refers more particularly to its organic constituents—

Water,	6.32
Oil,	36.55
Albuminous compounds,	18.41
Fibre, &c.,	34.59
Ash,	4.13
	100.00
Nitrogen,	2.93

The ash contained—

Phosphates,	1.98
Phosphoric acid in the alkaline salts,	0.60

In composition these seeds approximate very closely to the ordinary oily seeds, and in particular differ from linseed chiefly in the presence of a somewhat larger quantity of oil and a smaller amount of albuminous compounds, as may be more distinctly seen by comparing it with the subjoined analysis of a fair sample of that seed—

Water,	8.81
Oil,	31.80
Albuminous compounds,	23.44
Fibre, &c.,	31.07
Ash,	4.88
	100.00
Nitrogen,	3.25

The ash contained—

Phosphates,	1.44
Phosphoric acid in the alkaline salts,	0.63

As it is customary to estimate the feeding value chiefly by reference to the quantity of albuminous compounds, it appears that on this principle the madia seeds are inferior to linseed. But the propriety of this mode of estimation is very questionable, especially in seeds containing a large amount of oil, to which an important office in the nutrition of the animal body undoubtedly belongs, and it would probably be most correct to assume that the deficiency of the albuminous matters is counterbalanced by the excess of oil, and that the nutritive value of both is nearly equal. Whether the madia can be successfully cultivated in this country, or can compete with linseed, is a point which must be determined by experience; but it is worthy of note that linseed, in addition to its seed, yields a return in the shape of fibre which the *Madia sativa* does not, and for this reason I think it probable that it will not prove a profitable crop; but the seeds, which can be imported at a moderate price, merit attention as a feeding-stuff.

Linseed Boll Meal.—This substance is prepared by grinding the whole linseed bolls along with the light linseed blown from the seed by the cleaning-fan. It is a coarse meal, in which particles of the husk of the linseed are very distinctly visible. It contains—

Water,	9.85
Oil,	20.41
Albuminous compounds,	12.94
Fibre, &c.,	49.56
Ash,	7.24
	100.00
Nitrogen,	2.06

The ash contained—

Phosphates,	1.95
Phosphoric acid in the alkaline salts,	0.51

The presence of a large quantity of the external husks of the linseed has necessarily caused the value of this substance to stand considerably lower than that of pure linseed, for it has increased the quantity of fibre to almost exactly half the total weight of the meal, while in linseed it fell short of a third, and consequently depressed the quantity of oil and albuminous matters to a proportionate extent. But notwithstanding this, it is a very valuable feeding-substance, and will, in all probability, be found to exceed in nutritive value the common grains and bean meal. It has further the advantage of being cheaply prepared, being produced chiefly from linseed, which would bear only a very low price in the market.

Linseed Boll Cake.—This substance is prepared by mixing five parts of the preceding substance with one of pure linseed meal, and making it into a porridge with salt and hot water, and then

compressing it into a sort of soft cake, which breaks readily in the hand. Its composition is—

Water,	35.49
Oil,	6.94
Albuminous compounds,	7.94
Fibre, &c.,	42.73
Ash,	6.90
	100.00
Nitrogen,	1.26

The ash contains—

Phosphates,	1.93
Phosphoric acid in the alkaline salts,	0.19

In this mixture the quantity of oil appears considerably smaller than that in the meal itself, but the other constituents are reduced merely by the larger quantity of water it contains. It is no doubt a good form in which the substance may be used, but it cannot be advantageously produced for sale in this state, because, from the large quantity of water it contains, it is liable to undergo decomposition; and that analysed had begun to get mouldy, although it had been made for a short time only. Both these substances were manufactured at the flax-works near Aberdeen, and I am given to understand that they may be produced in very considerable quantities. They are certainly well worthy of attention, the more especially as they are an instance of working up, for feeding purposes, the inferior part of the crop, which would not meet with a ready sale for other purposes. It is on this principle that good and cheap cattle-food is to be obtained, and there are doubtless many cases in which damaged or light grain might be very advantageously consumed on the farm in feeding stock.

ON A DEPOSIT FROM A CAVE.

The substance in question, which almost deserves the name of a native guano, was found in a cave in Argyllshire. It forms a layer of considerable depth, and is a soft brown pulverulent matter almost entirely destitute of smell. It appears to have been produced chiefly by the droppings of deer which have taken refuge in the cave. Its analysis gave—

Water,	21.63
Organic matter,	50.91
Phosphate of lime,	3.41
Carbonate of lime,	3.53
Carbonate of magnesia,	4.56
Potash,	4.65
Soda,	5.39
Chlorine and sulphuric acid,	5.59
Sand,	0.33
	100.00
Ammonia,	2.17

If now we calculate according to the method usually employed in estimating the value of a manure from the price at which ammonia, phosphate of lime, and potash can be purchased, it appears that this deposit must be worth about £2, 16s. per ton; and if we choose to estimate the organic matter, magnesia, and soda, as is done by some chemists, its value would be almost exactly £4 per ton. This latter estimate, however, I consider to be an exaggeration; but I have no doubt it is well worth £2, 16s., and it is a great boon to the agriculturists of the district in which it is found, and will usefully replace both farmyard and artificial manures. Indeed its value is so considerable, that it ought to induce a search for similar deposits.

COMPOSITION OF LEONE ISLAND GUANO.

In previous Numbers of the *Transactions*, I have published analyses of all the new varieties of guano which have come under my hands, and I have now to add to the number what is called Leone Island guano. Of this substance I have analysed only one sample, and I do not therefore give it as representing the average composition of this variety, but rather as a warning that very inferior articles have been sold under this name.

Water,	23.65
Organic matter and ammoniacal salts,	4.27
Phosphates,	13.58
Sulphate of lime,	29.95
Alkaline salts,	5.40
Sand,	23.15
	100.00
Ammonia,	0.67
Phosphoric acid in the alkaline salts equal to 1.16 phosphate of lime,	0.52

This sample is consequently worth no more than £1, 12s. per ton. I do not know anything regarding the sample, which was sent to the Laboratory for analysis without any explanation, and it is probably inferior to the average, at least it is not likely that a deliberate attempt would be made to introduce at considerable expense a guano of so worthless a kind. At the same time our experience of new varieties of guano has not generally been such as to excite much confidence in them.

COMPOSITION OF SOME INFERIOR MANURES.

In accordance with the plan I have often adopted, of bringing under the notice of the farmer any instances of inferior manures which are met with in the course of laboratory work, I give here a few analyses which may serve as a warning, and show how much care is necessary in the purchase of such substances.

The first is, a substance sold under the name of Economic manure —a taking title, which has caused its consumption to some extent, although it is manurially of almost no value. Two analyses were made, with the following results:—

	No. 1.	No. 2.
Water,	9.85	9.91
Sulphate of iron,	32.15	21.98
Sulphate of lime,	22.34	24.66
Sulphate of magnesia,	"	11.35
Sulphate of soda,	14.04	22.74
Chloride of sodium,	16.53	5.38
Sulphate of ammonia,	2.09	"
Sand,	3.00	3.98
	100.00	100.00

Now this manure is obviously, under any circumstances, of very little value, for it contains in one case none, and in the other only a very small quantity, of the substances of most importance as constituents of plants; and its only constituents which are of use are sulphates of lime, soda, and magnesia, which are only occasionally advantageous, and on many soils produce little or no effect. If now we take these substances at their usual market price, it appears that the value of this manure is about £1, 14s. But this is more than ought to be paid—1st, Because these substances are only occasionally useful, and it is probable that in most instances only one of these, in which the soil happened to be deficient, would act; and, 2d, Because they are combined with sulphate of iron, which contains the protoxide of iron, a substance which is well known to operate very prejudicially in a large number of cases. Taking these points into account, I think no chemist would recommend this substance as a good manure, for all our knowledge leads to the opposite conclusion; and this is also the practical result, for in one case at least this Economic manure was used without the slightest effect on the crop, and in consequence payment was refused. The case came into court, and I understand the purchaser, having established in a satisfactory manner the failure of his crop, was found not to be liable for the price.

London Manure.—A substance has been sold under this name which is of low quality, although its price was considerable. It contained—

Water,	7.32
Organic matter,	41.42
Phosphates,	11.74
Sulphate of lime,	10.61
Alkaline salts,	1.17
Sand,	27.74
	100.00
Ammonia,	2.62

The value of this manure is £2, 5s. per ton.

Two substances sent to the Laboratory, and simply described as manures, were found to contain,—

	No. 1.	No. 2.
Water,	"	15.94
Organic matter,	"	2.07
Peroxide of iron,	4.94	5.12
Sulphate of lime,	14.21	0.72
Lime,	49.21	38.98
Magnesia,	0.61	0.50
Potash,	1.13	1.03
Soda,	1.21	1.85
Carbonic acid and sulphuretted hydrogen,	23.56	26.81
Sand,	5.13	6.98
	100.00	100.00

They are, of course, of comparatively little value, and useful only for the lime and small quantity of potash they contain. I suspect they are refuse matters obtained in the manufacture of potash salts—at least they very closely resemble two samples recently analysed under that name, which I subjoin, as they are more complete :—

	No. 1.	No. 2.
Water,	23.60	30.93
Potash,	2.47	0.62
Soda,	0.41	0.36
Peroxide of iron,	1.37	6.83
Alumina,	2.48	10.33
Lime,	25.85	29.82
Sulphurate of calcium,	5.13	"
Magnesia,	"	3.14
Sulphuric acid,	1.99	3.85
Carbonic acid,	14.23	1.67
Sand,	12.15	4.65
Charcoal,	10.32	7.80
	100.00	100.00

Our readers cannot fail to observe that all the substances of which analyses have been given would undoubtedly prove useful as manures, because all contain a greater or less proportion of those constituents which experience has shown to be of importance to the plants. The objection to them lies in the fact that the vendors do not sell them at a price properly proportioned to the quantity of valuable matters contained in them, but at a price fixed altogether irrespective of this question, and dependent either upon what is considered by them to be the ordinary cost of manures, or upon the cost of manufacture. If the cost of production is so great that these manures cannot be manufactured at a less rate, the sooner they are abandoned the better; but if the reverse is the case, it would be greatly to the advantage of both buyer and seller to have their prices fixed on some more equitable plan than that now in use.

COMPOSITION AND VALUATION OF SUPERPHOSPHATE OF LIME.

In these days, when the farmer is compelled to expend a large annual sum in the purchase of high-priced artificial manures, an accurate method of determining their composition and estimating their value becomes a problem of the very highest importance. Were it not for this, I should hesitate to recur to the subject of superphosphate of lime, which has already been repeatedly discussed by most agricultural chemists, and particularly by Professors Way and Voelcker, Mr Nesbit, and myself, and may be supposed to be thoroughly worked out. But the subject is one which cannot be too often brought under the notice of farmers, the more especially as both the composition and value of this manure are very fluctuating, and considerable changes have taken place in the aspect of the question within the last two years, which appear to me to render necessary some modifications in the mode of valuation hitherto adopted.

The plan employed by chemists in the valuation of a manure is abundantly simple. It proceeds upon the principle that its value depends on the presence of certain substances required for the growth of plants, each of which is found in other forms, and employed for other purposes, and has a definite commercial price at which it can be purchased in the market; and hence the price to be paid for any manure is determined by estimating the market-value of each of its *manurial* constituents, and adding the whole together. This principle would be strictly correct, if it were possible for the purchaser to make his own selection of the substances he proposed to employ; but in most instances this is not practicable, as the majority of manures are mixtures of a complicated nature, and the buyer is commonly compelled to take, besides the particular constituents he requires, others which he may consider unnecessary in his particular case. Thus, for example, if it has been ascertained that any particular soil is in no degree benefited by gypsum, but only by ammonia and phosphate of lime, but the farmer can only obtain a manure containing all these three substances, he will not allow any value for the former, because in his case it is unnecessary, and he is only compelled to take it because it happens to be mixed with those substances which he really requires. It is obvious that the most perfect plan of purchasing manures would be to have each of their constituents offered separately for sale, so that the farmer might have the opportunity of purchasing only what he required, and making a mixture such as his experience had shown to be adapted to each particular soil. But practically this plan is impossible, for each constituent, in its pure and unmixed state, bears a high price, because it is then applicable to other purposes; and it is only when it exists in the form of

compounds, from which it cannot be easily and cheaply extracted, that its price is sufficiently low to permit its use as a manure.

Taking the question of manuring in the most general point of view, it is obvious that a manure ought to return to the soil all those substances which the crops have removed from it, if an equal crop is to be obtained in subsequent years. But practically it is found that this rule may be to a certain extent departed from, because many soils contain within them an abundant supply of some of these substances, and hence it is unnecessary to do more than merely to add such as are absolutely defective. Experience points in this climate, and in ordinary soils, to nitrogen, phosphoric acid, and potash, as those most generally deficient, and consequently the most important and essential constituents of manures; and we propose to consider the sources from which each of these substances can be derived, and the price which must be paid for them in the market, and we shall find that most of them may be obtained in several different forms.

Nitrogen.—In considering the sources of this element, it is perhaps unnecessary to remind our readers that it is only available to the plant when in the state of ammonia or nitric acid, and principally in the former. Ammonia, in its pure or uncombined state, is met with in gas-water, and in this form it can be purchased at a lower rate than in any other, for the price at which it is sold is such that the ammonia contained in it costs from 3d. to 4d. per lb., or at the rate of from £28 to £37 per ton. But the use of this fluid as a manure is limited both by its bulk and the consequent difficulty of transporting it, and by the fact that it must be employed in the liquid form, and is also liable to loss by evaporation. Hence it follows, that to bring it into a condition in which it may be conveniently used, and the risk of loss by evaporation prevented, it must be made solid. For this purpose it is necessary to combine it with some acid, and sulphuric acid, as the cheapest, is that usually employed. Now, 3 tons of sulphuric acid are requisite to combine with and fix 1 ton of ammonia, and as it costs from £5 to £6 per ton, £15 to £18 is at once added to the price of the ammonia, besides the cost of manufacture, so that a ton of ammonia, in the form of sulphate, cannot well be sold, with a profit, at a price much under from £50 to £60. In point of fact, it is at the present moment considerably higher, for sulphate of ammonia is now selling at £17 and £18 per ton, at which rate a ton of ammonia costs £72. If now we select another great source of ammonia—namely, Peruvian guano—we find that we may calculate its price by deducting the value of the phosphate of lime and other valuable matters it contains; for which purpose, however, we are compelled to make some assumptions, one at least of which may be considered as open to some doubt. An average Peruvian guano has the following composition:—

Water,	13.73
Organic matter and ammoniacal salts,	53.16
Phosphates,	23.48
Alkaline salts,	7.97
Sand,	1.66
	100.00
Ammonia,*	16.50
Phosphoric acid in the alkaline salts, equal to 5.21 phosphate of lime,	2.50

We shall afterwards see that phosphates may be purchased at about £7 per ton, and we shall assume for the present that the phosphoric acid in the alkaline salts is in the state of soluble phosphates, which may be reckoned at the price of £30 per ton. We calculate then, as follows, the value of these substances in 100 tons of guano:—

23.48 tons phosphate at £7,	£164	7	0
5.21 tons soluble phosphate at £30,	156	0	0
	£320	7	0

At the present moment Peruvian guano sells at from £12, 12s. 6d. to £13, and consequently the price paid for 16.5 tons of ammonia, the quantity contained in 100 tons of guano, is £955, or almost exactly £58, 10s. per ton. By pursuing the valuation of the ammonia in other substances, it will be found that, on the whole, a reasonable and fair average is £56 per ton; and this is the rate adopted both by Professor Way and myself, for some years back. It is perhaps a little under the present market-price, which is unusually high, but the difference is so small as to be of comparatively little importance.

Nitrogen, as already remarked, may also be purchased in the form of nitrate of soda, but it is then much more expensive, for at present a quantity equivalent to a ton of ammonia costs from £86 to £90; and hence it need not enter into our present calculation, which refers to ordinary manures, and not to substances applicable as top-dressings.

Phosphates.—These substances may be obtained either from coprolites, spent animal-charcoal, bone-ash, or bones themselves. In the three former substances there is no valuable matter except the phosphate of lime, but in the last a considerable part of the value is due to the nitrogenous animal matters they contain, which are capable of yielding from 4 to 4.5 per cent of ammonia. An average sample of bones, costing from £6 to £6, 10s. per ton, contains—

* Chemists used to assume 17.5 as the per-centage of ammonia, but recent cargoes do not give so high an average. Professor Way, who has also observed this fact, attributes it to his samples having formerly been taken from the ship; but I think I have been able to see that the average varies in different seasons; and I imagine it depends upon the part of the guano islands at which they happen to work.

Water,	6.81
Organic matter,	31.41
Phosphate of lime,	49.69
Carbonate of lime,	3.67
Alkaline salts,	2.32
Sand,	6.10
	100.00
Ammonia,	4.46

The ammonia in 100 tons of this sample would be worth, at the rate of £56 per ton, almost exactly £250, which would leave for the phosphates £350, or £7 per ton. Bone-ash and spent animal-charcoal, containing 70 per cent of phosphates, are sold at £5, 10s. or £6 per ton, and at the former rate the phosphates cost about £8 per ton. And coprolites are at present sold at £4, 10s. per ton, a price which makes the phosphates cost nearly £9 per ton. The latter is a most extravagant price, and we cannot understand how it can be obtained, the more especially as the phosphates in that substance are actually less valuable than in any other form, because they are less soluble, and consequently less available for the plant. We shall fix £7 per ton as the fair value of phosphates, and the price at which they can generally be obtained from all their sources; for though at present the prices are higher than this, it is not likely that they will remain permanently at these rates.

Potash is less important for our present purposes, as it is comparatively rarely found in manures. It occurs, however, in Peruvian guano to the extent of 3 per cent. Potash is met with in commerce in several different forms; but the cheapest, and consequently those which can be most advantageously used as manures, are the sulphate and muriate obtained from kelp. These salts are at present very high in price—the sulphate, containing 50 per cent, selling at £7, 10s.; and the muriate, of 80 per cent, at £14 per ton; or at the rates of £27, 14s. and £35 per ton. These values are chiefly important to us at present, as indicating that the value taken for the ammonia in guano is above the mark, because we have not estimated the potash in the calculation given in a former page.

We proceed now to apply these estimates to the valuation of superphosphate, and on examining the analysis of that manure, we find that there are present in it several substances not yet considered. An ordinary superphosphate has the following composition—

Water,	13.24
Organic matter,	7.89
Soluble phosphates,	15.57
Insoluble phosphates,	16.53
Sulphate of lime,	20.75
Sulphuric acid,	13.00
Alkaline salts,	1.96
Sand,	11.06
	100.00
Ammonia,	1.13

There are three substances contained in this analysis, the valuation of which must be considered—namely, soluble phosphates, sulphuric acid, and sulphate of lime. The two latter are commercial articles of well-known price, and no difficulty can arise as to their cost; but, as we shall immediately see, it is very doubtful whether they ought to be estimated at all. In valuing the soluble phosphates, which are the characteristic ingredients of a superphosphate, a difficulty lies in the fact that these substances are met with in no other form, and their price must therefore be deduced from that of an average superphosphate.

Before discussing this point, however, it is essential to ascertain whether any value should be allowed for the sulphuric acid and sulphate of lime, on which point some difference of opinion may exist. Taking all things into consideration, it appears to me that they ought not to be valued, because they are there not for the benefit of the farmer so much as for the convenience of the manufacturer. Agriculture has demanded a manure containing phosphate of lime in a soluble form, and in order to fulfil this requirement, the manufacturer of superphosphate adds sulphuric acid, one portion of which decomposes any carbonate of lime which may happen to be present, and the other acts as a solvent of the phosphates, so that they are there merely as a means to an end, and not with the intention that they shall themselves act as manurial substances. It may be alleged that both must act as such, but it is to be noted that nothing is known as to the value of sulphuric acid as a manure when used in the uncombined state, and sulphate of lime is only employed with advantage on particular soils and crops. Neither is their valuation a matter of much consequence, in a practical point of view, because if a price be fixed for them, it only produces a corresponding diminution in the value of the soluble phosphates, which must be deduced from that of the manure itself. The effect will be more obvious if we value the sample of which we have already given the analysis, both with and without estimating the sulphuric acid and sulphate of lime. The following estimate refers to 100 tons of the manure:—

15.53 tons of insoluble phosphates, at £7,	£115	14	0
1.13 „ ammonia, at £56,	63	6	0
	£179	0	0
Price of 100 tons of superphosphate,	£700	0	0
Deduct value of insoluble phosphates and ammonia,	179	0	0
Price paid for 15.57 tons soluble phosphates,	£521	0	0

The value of 1 ton of soluble phosphates is consequently £33, 8s. If now the sulphuric acid and sulphate of lime are to be estimated, the case stands as follows:—

Value of insoluble phosphates and ammonia, as above,	£179	0	0
13 tons sulphuric acid, at £7,	91	0	0
20.75 tons sulphate of lime at £1, 10s.,	31	0	0
	£301	0	0

Deducting this as before from £700, leaves £399 as the price of the soluble phosphates, being at the rate of £25, 12s. per ton. The real difference in the mode of calculation lies in the fact, that in the former case the price of the soluble phosphates is made to cover that of the sulphuric acid, used to bring them into the soluble state; while in the latter each is estimated separately. It is obvious that the final result is the same in both cases; and the former, being the simpler, ought, in my opinion, to be universally adopted, and it is that used both by Professor Way and myself. The most important question is the determination of the price which ought to be paid for soluble phosphates, and here we are met by the difficulty of fixing the fair average composition of a superphosphate, which differs excessively. In order to show how great these differences are, I have collected all the analyses made in the Laboratory, commencing with the year 1852, previous to which time the number is too small to afford any results of value. In each case the value of the insoluble phosphates and ammonia is given, and then that of the soluble phosphates deduced from that of the manure: as, however, I do not know the actual price paid for each sample, the calculation has been made, first on the supposition that the superphosphates cost £7 per ton; and secondly, at the rate of £8, between which the price of most superphosphates is included. The analyses of each year have been kept separate, and the average is placed at the end.

1852.

No.	Water.	Organic Matter.	Soluble Phosphates.	Insoluble Phosphates.	Sulphate of Lime.	Sulphuric Acid.	Alkaline Salts.	Sand.	Ammonia.	Value of the Insoluble Phosphates and Ammonia in 100 tons.	Price paid for the Soluble Phosphates in 100 tons, when the Superphosphate costs £7 per ton.	Price paid for one ton Soluble Phosphates.	Price paid for the Soluble Phosphates in 100 tons, when the Superphosphate costs £8 per ton.	Price paid for one ton Soluble Phosphates.
1	13.57	30.67	7.01	25.05	8.81	7.41	0.59	6.89	3.17	£352 0 0	£348 0 0	£49 14 0	£448 0 0	£64 0 0
2	11.32	9.33	8.79	13.47	22.88	9.44	16.76	7.53	0.80	139 2 0	560 18 0	63 14 0	660 18 0	75 4 0
3	18.98	12.00	3.09	11.21	19.03	7.97	19.99	7.73	2.77	234 12 0	465 8 0	150 0 0	565 8 0	182 18 0
4	10.77	2.72	10.36	20.30	29.97	12.70	5.93	7.25	1.11	204 6 0	496 14 0	47 18 0	596 14 0	57 12 0
5	20.08	15.28	7.48	10.55	13.29	5.16	—	28.16	1.57	161 16 0	538 4 0	72 0 0	638 4 0	85 8 0
6	14.04	9.76	7.42	17.23	30.46	2.39	10.79	7.91	0.72	160 18 0	539 2 0	72 14 0	639 2 0	86 2 0
7	13.82	21.01	4.81	24.13	21.58	6.50	—	7.38	3.76	379 10 0	320 10 0	66 12 0	420 10 0	87 8 0
8	14.64	6.67	3.37	25.89	27.67	5.42	2.98	13.36	—	181 4 0	518 16 0	153 18 0	618 16 0	183 12 0
9	7.93	9.33	11.20	17.74	28.76	7.21	8.89	8.94	0.98	176 1 0	523 19 0	46 14 0	623 19 0	55 14 0
Average for 1852,	13.90	12.99	7.06	18.40	22.49	7.13	7.32	10.57	1.54			£80 7 0		£97 8 0

1853.

No.	Water.	Organic Matter.	Soluble Phosphates.	Insoluble Phosphates.	Sulphate of Lime.	Sulphuric Acid.	Alkaline Salts.	Sand.	Ammonia.	Value of the Insoluble Phosphates and Ammonia in 100 tons.	Price paid for the Soluble Phosphates in 100 tons, when the Superphosphate costs £7 per ton.	Price paid for one ton Soluble Phosphates.	Price paid for the Soluble Phosphates in 100 tons, when the Superphosphate costs £8 per ton.	Price paid for one ton Soluble Phosphates.
10	13.30	11.58	6.55	23.36	25.61	7.87	5.76	5.97	3.76	£374 2 0	£326 18 0	£49 18 0	£426 18 0	£65 2 0
11	11.58	—	14.48	23.49	25.80	12.31	6.62	5.72	0.62	200 3 0	499 17 0	34 10 0	599 17 0	41 8 0
12	23.15	18.51	10.70	11.40	13.33	9.55	12.08	1.28	2.22	204 2 0	495 18 0	46 6 0	595 18 0	55 14 0
13	10.83	13.30	3.13	14.39	40.66	10.84		6.85	1.88	206 0 0	494 0 0	157 16 0	594 0 0	189 14 0
14	23.97	16.18	19.58	7.60	11.39	12.93	2.54	5.81	1.32	127 2 0	572 18 0	29 4 0	672 18 0	34 6 0
15	22.38	5.91	12.11	17.26	20.74	11.07	6.87	3.66	0.95	174 0 0	526 0 0	43 8 0	626 0 0	51 16 0
16	22.53	15.34	11.93	17.13	22.75	6.37	1.44	2.51	0.63	155 4 0	544 16 0	45 14 0	644 16 0	54 0 0
17	13.99	11.26	10.35	25.18	23.74	5.12	3.23	8.93	0.82	222 2 0	477 18 0	46 4 0	577 18 0	55 16 0
18	10.43	3.61	13.12	24.47	25.63	4.69	7.71	10.34	0.54	201 10 0	498 10 0	38 0 0	598 10 0	45 12 0
19	10.18	18.62	12.22	16.22	22.23	5.56	8.98	5.99	1.37	190 4 0	509 16 0	41 14 0	609 16 0	49 18 0
20	18.20	41.75	5.28	18.73	3.06	4.56	7.16	1.26	9.87	683 16 0	16 4 0	3 2 0	116 4 0	22 0 0
21	23.52	13.73	12.11	12.69	17.47	—	3.02	17.46	0.91	139 14 0	560 6 0	46 4 0	660 6 0	54 10 0
22	19.97	7.78	17.05	9.97	23.27	12.22	—	9.54	0.99	125 4 0	574 16 0	33 14 0	674 16 0	39 12 0
23	19.48	8.83	12.45	12.65	29.02	8.63	—	8.94	0.73	129 6 0	570 14 0	45 16 0	670 14 0	53 16 0
24	6.83	4.53	10.20	20.82	34.16	5.68	5.38	12.40	0.82	191 12 0	508 8 0	49 16 0	608 8 0	59 12 0
Average for 1853,	16.69	12.60	11.42	17.02	22.59	7.10	4.72	7.86	1.79			£50 12 0		£58 4 0

1854.

No.	Water.	Organic Matter.	Soluble Phosphates.	Insoluble Phosphates.	Sulphate of Lime.	Sulphuric Acid.	Alkaline Salts.	Sand.	Ammonia.	Value of the Insoluble Phosphates and Ammonia in 100 tons.	Price paid for the Soluble Phosphates in 100 tons, when the Superphosphate costs £7 per ton.	Price paid for 1 ton Soluble Phosphates.	Price paid for the Soluble Phosphates in 100 tons, when the Superphosphate costs £8 per ton.	Price paid for 1 ton Soluble Phosphates.
25	22.95	13.00	24.39	.88	17.31	14.74	3.68	3.05	1.34	£81 2 0	£618 18 0	£25 8 0	£718 18 0	£29 8 0
26	19.15	6.67	13.20	4.02	39.92	.500	5.65	6.39	.72	68 9 0	631 11 0	47 16 0	731 11 0	55 8 0
27	23.24	3.84	6.20	25.49	28.94	1.83	3.30	7.16	.25	192 8 0	507 12 0	82 0 0	607 12 0	98 0 0
28	19.41	7.02	3.64	30.38	27.46	—	2.16	9.93	.49	240 1 0	459 19 0	123 8 0	559 19 0	153 18 0
29	24.65	9.09	17.17	1.92	29.58	6.71	6.85	4.03	.69	52 0 0	648 0 0	37 3 0	748 0 0	43 12 0
30	24.24	1.87	15.86	4.10	30.40	12.87	1.25	9.41	.50	56 14 0	643 6 0	40 10 0	743 6 0	46 18 0
31	17.38	2.12	7.91	27.60	28.26	4.16	3.47	9.10	.09	198 4 0	501 16 0	63 8 0	601 16 0	76 2 0
32	19.97	7.78	17.05	9.97	23.27	12.22	0.20	9.54	.99	125 4 0	574 16 0	33 14 0	674 16 0	39 8 0
33	6.83	4.53	10.02	21.00	34.16	5.68	5.38	12.40	.82	192 18 0	507 2 0	50 12 0	607 2 0	60 12 0
34	18.65	7.05	13.28	10.23	33.13	12.01	.21	5.45	.63	106 18 0	593 2 0	44 12 0	693 2 0	52 4 0
35	20.02	12.65	21.23	9.81	15.53	16.69	—	4.43	1.88	173 18 0	526 2 0	24 16 0	626 2 0	29 10 0
36	18.81	11.83	6.91	13.20	25.26	7.29	3.42	12.28	1.51	176 19 0	523 1 0	75 14 0	623 1 0	90 2 0
37	16.37	16.74	4.13	18.79	24.23	4.65	2.42	12.67	1.54	217 16 0	482 4 0	116 14 0	582 4 0	140 18 0
38	22.74	4.12	13.57	5.43	27.58	10.42	3.18	12.96	0.50	66 0 0	634 0 0	46 14 0	734 0 0	54 2 0
39	17.08	15.14	20.22	17.61	7.71	15.72	2.35	4.17	1.11	184 9 0	515 11 0	25 10 0	615 11 0	30 8 0
40	28.79	6.19	10.34	22.41	23.92	2.78	2.54	3.00	0.10	162 10 0	537 10 0	51 19 0	637 10 0	61 12 0
41	9.24	10.29	4.72	23.75	31.23	3.86	8.54	8.37	1.48	249 2 0	450 18 0	95 10 0	550 18 0	116 14 0
42	20.88	7.05	15.19	5.16	37.43	5.76	3.82	4.71	0.40	58 10 0	641 10 0	42 4 0	741 10 0	48 16 0
43	25.36	—	9.47	5.21	31.66	12.92	9.34	6.04	1.57	144 7 0	555 13 0	58 14 0	655 13 0	69 2 0
44	20.02	4.14	13.77	9.02	35.75	10.90	1.48	4.97	0.21	74 18 0	625 2 0	45 8 0	725 2 0	52 14 0
45	23.27	1.06	8.61	5.76	34.27	14.14	9.82	3.07	—	40 6 0	659 14 0	76 12 0	759 14 0	88 4 0
46	20.30	3.16	14.11	5.07	41.72	9.32	2.40	3.91	—	35 10 0	664 10 0	47 2 0	764 10 0	54 3 0
Average for 1854	21.48	7.20	10.82	12.60	28.58	8.63	3.55	7.14	0.76			£57 2 0		£66 16 0

1855.

No.	Water.	Organic Matter.	Soluble Phosphates.	Insoluble Phosphates.	Sulphate of Lime.	Sulphuric Acid.	Alkaline Salts.	Sand.	Ammonia.	Value of the Insoluble Phosphates and Ammonia in 100 tons.	Price paid for the Soluble Phosphates in 100 tons, when the Superphosphate costs £7 per ton.	Price paid for one ton Soluble Phosphates.	Price paid for the Soluble Phosphates in 100 tons, when the Superphosphate costs £8 per ton.	Price paid for one ton Soluble Phosphates.
47	24.33	10.60	14.38	14.36	16.00	6.48	3.98	9.87	1.03	£158 2 0	£541 18 0	£36 18 0	£641 18 0	£44 12 0
48	10.70	12.74	15.08	18.01	2.22	18.39	13.06	9.80	2.07	241 18 0	458 2 0	30 6 0	558 2 0	37 0 0
49	23.77	3.00	12.19	7.77	36.23	8.44	0.01	8.59	0.49	81 14 0	618 6 0	50 14 0	718 6 0	58 18 0
50	13.60	24.90	8.71	29.14	10.76	7.49	1.82	3.58	3.13	379 2 0	320 18 0	36 16 0	420 18 0	48 6 0
51	18.20	2.83	14.04	6.15	36.88	11.51	3.17	7.22	0.56	74 6 0	625 14 0	44 10 0	725 14 0	51 12 0
52	8.43	0.00	15.37	15.07	36.03	11.24	1.60	12.26	0.00	105 8 0	594 12 0	38 12 0	694 12 0	45 2 0
53	13.84	7.95	14.18	7.44	21.71	19.62	3.92	11.34	0.93	104 0 0	596 0 0	42 0 0	696 0 0	49 0 0
54	16.10	10.53	10.62	10.48	3.92	33.89	19.55	4.91	0.80	118 2 0	581 18 0	54 14 0	681 18 0	64 4 0
55	17.22	14.83	4.50	31.35	18.74	4.43	1.20	7.73	3.25	401 8 0	298 12 0	66 6 0	398 12 0	88 10 0
56	19.09	2.45	9.49	4.52	43.49	7.27	1.51	12.18	1.00	87 12 0	612 8 0	64 10 0	712 8 0	75 0 0
57	18.69	2.44	14.18	9.66	36.32	12.22	4.37	2.12	0.60	101 4 0	598 16 0	42 4 0	698 16 0	49 4 0
58	23.78	1.70	10.24	7.95	38.56	4.15	7.56	6.06	0.45	80 16 0	619 4 0	60 8 0	719 4 0	70 4 0
59	21.04	12.42	10.16	9.58	33.90	3.94	2.46	6.50	1.10	128 13 0	571 7 0	56 4 0	671 7 0	66 1 0
60	23.51	a trace	6.02	12.86	39.19	5.44	7.34	5.64	0.31	110 6 0	589 14 0	97 18 0	689 14 0	114 10 0
61	32.39	8.63	12.97	16.12	18.54	6.10	3.32	1.93	0.79	157 0 0	543 0 0	41 18 0	643 0 0	49 12 0
62	17.46	—	18.82	3.54	25.13	17.87	—	17.90	0.13	32 0 0	668 0 0	34 18 0	768 0 0	40 16 0
63	16.24	1.52	11.18	15.22	23.69	16.60	11.55	4.00	0.29	122 16 0	577 4 0	51 12 0	677 4 0	60 12 0
64	14.00	0.63	13.90	23.98	31.57	8.24	1.06	6.62	0.60	201 9 0	498 11 0	35 18 0	598 11 0	43 0 0
65	18.26	11.95	7.06	31.27	11.93	4.93	11.18	3.42	3.24	400 2 0	299 18 0	42 6 0	399 18 0	56 12 0
66	33.99	9.94	16.11	9.98	15.01	8.98	2.67	3.32	0.93	121 19 0	578 1 0	35 18 0	678 1 0	42 2 0
67	17.50	15.63	13.08	24.65	15.87	6.23	4.63	2.41	2.35	294 2 0	405 18 0	31 0 0	505 18 0	38 12 0
68	23.89	10.46	8.63	5.67	25.74	15.43	3.94	6.24	3.05	210 10 0	489 10 0	56 14 0	589 10 0	67 2 0
69	17.02	13.04	4.61	19.88	22.17	7.79	0.46	15.03	0.85	189 15 0	510 5 0	110 14 0	610 5 0	132 6 0
70	22.80	6.09	6.67	10.76	26.61	4.08	13.16	9.83	0.34	94 11 0	605 9 0	90 16 0	705 9 0	105 16 0
71	21.51	10.28	17.17	22.54	21.25	4.83	—	2.42	0.88	207 1 0	492 19 0	28 14 0	592 19 0	34 10 0
72	8.48	3.95	11.54	16.69	41.62	8.86	2.42	6.64	1.21	184 12 0	515 8 0	44 18 0	615 8 0	53 6 0
73	18.90	3.31	12.38	8.31	41.38	6.96	6.88	1.88	0.64	94 0 0	606 0 0	48 18 0	706 0 0	57 0 0
74	13.24	7.89	15.57	16.53	20.75	13.00	1.96	11.06	1.13	179 0 0	521 0 0	33 8 0	621 0 0	39 18 0
75	3.51	17.72	15.43	22.21	19.68	15.32	2.24	3.89	3.11	329 12 0	370 8 0	24 0 0	470 8 0	30 10 0
76	19.50	13.51	7.32	11.67	21.13	7.90	7.60	11.37	0.86	129 16 0	570 4 0	77 14 0	670 4 0	91 10 0
77	41.56	32.19	5.47	—	2.95	—	1.07	16.76	0.37	20 14 0	679 6 0	124 4 0	779 6 0	142 8 0
78	22.70	6.50	18.15	10.23	14.67	18.98	5.02	3.75	0.70	110 16 0	589 4 0	32 8 0	689 4 0	37 18 0
79	15.51	10.32	12.50	13.69	24.19	10.69	7.93	5.24	0.87	144 10 0	555 10 0	44 8 0	655 10 0	52 8 0
80	15.17	4.91	12.57	14.04	26.24	14.49	8.05	4.53	1.39	176 2 0	523 18 0	41 12 0	623 18 0	49 12 0

1855.—(*Continued.*)

No.	Water.	Organic Matter.	Soluble Phosphates.	Insoluble Phosphates.	Sulphate of Lime.	Sulphuric Acid.	Alkaline Salts.	Sand.	Ammonia.	Value of the Insoluble Phosphates and Ammonia in 100 tons.	Price paid for the Soluble Phosphates in 100 tons, when the Superphosphate costs £7 per ton.	Price paid for one ton Soluble Phosphates.	Price paid for the Soluble Phosphates in 100 tons, when the Superphosphate costs £8 per ton.	Price paid for one ton Soluble Phosphates.
81	21.86	7.50	16.47	10.29	13.66	21.38	6.35	2.49	.82	£117 18 0	£582 2 0	£35 6 0	£682 2 0	£41 8 0
82	28.79	10.50	11.25	22.74	12.40	9.04	1.87	3.41	.30	176 0 0	524 0 0	46 12 0	624 0 0	55 8 0
83	16.06	12.78	12.29	19.67	17.71	8.39	4.80	8.30	.69	176 6 0	523 14 0	42 12 0	623 14 0	50 14 0
84	15.96	7.23	12.19	33.98	13.46	12.19	1.78	3.21	.24	251 6 0	448 14 0	36 16 0	548 14 0	45 0 0
Average for 1855,	19.20	5.70	11.81	14.63	23.19	10.60	2.31	12.56	1.10			£50 8 0		£60 0 0
1856.														
85	17.52	4.47	11.31	9.58	37.64	10.44	6.99	2.05	.97	£121 8 0	£578 12 0	£51 2 0	£678 12 0	£60 0 0
86	16.32	4.36	11.51	16.71	31.30	9.56	2.01	8.23	.91	167 18 0	532 2 0	46 4 0	632 2 0	54 18 0
87	14.02	12.25	9.12	21.11	15.14	17.66	5.27	5.43	2.52	288 18 0	411 2 0	45 0 0	511 2 0	56 0 0
88	17.85	9.15	19.65	7.35	13.56	15.39	15.55	1.52	2.39	185 6 0	514 14 0	26 4 0	614 14 0	31 6 0
89	20.25	6.21	16.93	10.73	22.93	13.61	6.68	2.66	.44	101 14 0	598 6 0	35 6 0	698 6 0	41 4 0
90	22.93	7.47	15.12	10.15	23.03	14.89	—	6.77	.19	81 13 0	618 7 0	40 18 0	718 7 0	47 10 0
91	15.91	6.29	20.62	19.69	13.40	16.09	2.20	5.80	.34	156 17 0	543 3 0	26 6 0	643 3 0	31 4 0
92	31.75	8.21	19.38	14.06	14.83	9.50	—	2.27	.39	119 16 0	580 4 0	29 18 0	680 4 0	35 2 0
93	34.36	6.48	23.27	13.05	3.02	15.29	2.12	2.41	.49	118 15 0	581 5 0	24 18 0	681 5 0	29 4 0
94	26.43	12.19	19.69	10.01	15.13	12.54	2.10	1.91	1.62	160 14 0	539 6 0	27 8 0	639 6 0	32 8 0
95	17.04	25.58	7.09	22.45	13.68	7.03	5.49	1.64	2.50	297 3 0	402 17 0	56 12 0	502 17 0	70 18 0
96	12.26	12.86	10.90	5.71	7.36	12.52	34.80	3.59	1.53	125 13 0	574 7 0	52 14 0	674 7 0	61 18 0
97	18.39	13.12	14.19	21.15	15.66	9.39	1.78	6.32	2.67	297 11 0	402 9 0	28 6 0	502 9 0	35 8 0
98	19.83	7.27	22.82	3.51	17.13	16.53	6.87	6.04	.49	51 10 0	648 10 0	28 8 0	748 10 0	32 14 0
99	20.85	.68	15.66	22.97	27.52	9.43	1.06	6.83	.41	183 15 0	516 5 0	48 8 0	616 5 0	57 16 0
100	16.05	10.30	25.89	3.61	17.72	17.84	4.24	4.35	.17	34 16 0	665 4 0	25 14 0	765 4 0	25 10 0
101	6.75	21.70	12.38	28.50	13.14	13.53	—	4.00	3.24	380 18 0	319 2 0	25 14 0	419 2 0	33 16 0
102	10.15	8.23	12.45	23.63	27.25	8.88	2.21	7.70	.79	209 13 0	490 7 0	38 8 0	590 7 0	47 8 0
103	10.71	7.82	15.74	17.96	29.58	8.15	4.04	6.00	.82	171 12 0	528 8 0	33 10 0	628 8 0	39 18 0
104	11.23	8.40	9.11	21.23	30.36	7.17	4.41	8.09	.65	184 .0 0	516 0 0	56 12 0	616 0 0	67 12 0
105	17.36	8.11	36.40	7.24	2.34	20.75	—	7.80	.36	70 17 0	629 3 0	17 6 0	729 3 0	20 0 0
106	17.98	3.51	31.47	.40	19.05	21.44	2.43	3.72	.31	20 3 0	679 17 0	21 12 0	779 17 0	24 14 0
107	15.45	4.11	18.86	18.00	13.52	14.05	2.70	13.31	.45	151 4 0	548 16 0	29 2 0	648 16 0	34 8 0
108	8.29	9.21	17.77	30.37	13.00	14.85	.35	6.16	.08	217 2 0	482 18 0	27 4 0	582 18 0	32 16 0
109	19.95	7.37	9.50	22.47	19.26	15.07	.63	5.75	.54	187 10 0	512 10 0	53 18 0	612 10 0	64 10 0
110	20.60	8.15	16.06	8.68	32.59	6.85	1.91	5.16	.32	78 14 0	621 6 0	38 14 0	721 6 0	44 18 0
111	23.26	9.16	22.86	11.28	12.25	14.70	2.93	3.56	1.75	176 19 0	523 1 0	22 18 0	623 1 0	27 4 0

1856—(*Continued.*)

No.	Water.	Organic Matter.	Soluble Phosphates.	Insoluble Phosphates.	Sulphate of Lime.	Sulphuric Acid.	Alkaline Salts.	Sand.	Ammonia.	Value of the Insoluble Phosphates, and Ammonia in 100 tons.	Price paid for the Soluble Phosphates in 100 tons, when the Superphosphate costs £7 per ton.	Price paid for one ton Soluble Phosphates.	Price paid for the Soluble Phosphates in 100 tons, when the Superphosphate costs £8 per ton.	Price paid for one ton Soluble Phosphates.
112	7.14	31.29	7.19	33.18	8.62	5.36	4.71	2.51	4.82	£492 3 0	£207 17 0	£28 18 0	£307 17 0	£42 16 0
113	23.96	11.04	18.03	15.21	12,68	14.27	2.76	2.05	1.38	183 15 0	516 5 0	28 12 0	616 5 0	34 4 0
114	19.35	20.45	9.79	1.10	28.35	13.71	1.07	6.18	0.99	63 2 0	636 18 0	65 0 0	736 18 0	75 4 0
115	6.38	20.96	11.20	31.86	8.88	15.59	1.98	3.15	1.58	311 10 0	388 10 0	34 14 0	488 10 0	43 12 0
116	7.74	13.70	12.73	17.31	16.12	15.61	10.29	6.50	1.41	200 2 0	499 18 0	39 6 0	599 18 0	47 2 0
117	7.31	11.08	12.06	23.52	23.99	8.89	4.76	8.39	0.90	215 0 0	485 0 0	40 4 0	585 0 0	48 10 0
118	14.73	9.11	8.57	9.57	31.38	4.13	3.49	19.02	0.38	88 5 0	611 15 0	71 8 0	711 15 0	81 18 0
119	25.44	3.89	16.58	22.44	9.43	19.78	—	2.44	1.15	221 9 0	478 11 0	28 16 0	578 11 0	34 16 0
120	5.41	5.60	30.60	13.56	18.55	19.78	0.43	6.07	0.57	126 17 0	573 3 0	18 14 0	673 3 0	21 18 0
121	12.84	23.90	10.70	28.88	4.45	13.08	1.86	4.29	2.72	354 10 0	345 10 0	32 6 0	445 10 0	41 12 0
122	7.79	3.87	7.59	19.21	45.22	7.39	1.84	7.09	0.25	148 9 0	551 11 0	72 12 0	651 11 0	85 18 0
123	15.52	7.07	13.28	23.84	22.85	9.17	2.70	5.57	0.23	173 15 0	526 5 0	39 12 0	626 5 0	47 2 0
124	10.33	10.93	14.27	16.37	19.60	16.18	5.07	7.25	1.02	161 14 0	538 6 0	37 14 0	638 6 0	44 14 0
125	21.51	15.45	15,21	10.65	18.63	11.69	3.01	3.85	1.65	166 19 0	533 1 0	35 0 0	633 1 0	41 12 0
126	17.30	9.61	25.52	8.65	16.02	17.16	1.49	3.65	—	60 11 0	639 9 0	25 0 0	739 9 0	28 18 0
127	20.61	13.56	24.50	1.86	15.63	19.72	1.14	2.98	0.38	34 6 0	665 14 0	27 4 0	765 14 0	31 4 0
128	17.01	20.44	4.50	13.53	22.85	8.97	10.30	2.40	2.52	235 16 0	464 4 0	103 4 0	564 4 0	125 8 0
129	15.93	11.37	9.18	25.40	22.91	9.04	0.27	5.90	0.96	231 11 0	468 9 0	51 0 0	568 9 0	61 18 0
130	15.00	11.49	33.76	3.91	9.98	19.53	3.05	3.28	0.32	45 6 0	654 14 0	19 8 0	754 14 0	22 6 0
131	10.43	19,24	20.64	24.62	1.43	18.05	0.41	4.68	2.30	301 2 0	398 18 0	19 6 0	498 18 0	24 4 0
132	19.92	7.01	31,71	6.73	18.80	13.44	—	2.39	0.39	68 19 0	631 1 0	19 18 0	731 1 0	23 0 0
133	11.34	16.70	14.74	31.24	7.03	15.75	—	2.70	1.36	294 16 0	405 4 0	27 10 0	505 4 0	34 6 0
134	7.67	9.95	35,17	13.14	11.57	19.74	—	2.76	0.18	102 1 0	597 19 0	14 2 0	697 19 0	19 16 0
135	22.80	9.01	13.36	11.80	22.94	10.55	2.51	7.02	0.52	112 4 0	587 16 0	44 0 0	687 16 0	51 10 0
136	21.00	11.31	4.85	18.22	20.93	5.29	14.26	4.14	2.27	254 13 0	445 7 0	91 16 0	545 7 0	112 8 0
137	22.05	10.63	13,11	10.39	31,96	7.20	—	4.66	0.54	102 19 0	597 1 0	45 10 0	697 1 0	53 3 0
138	11.08	3.50	42.51	10.09	6.32	24.61	0.97	0.92	—	70 12 0	629 8 0	14 16 0	729 8 0	17 2 0
139	10.50	30.68	7.84	22.84	5.50	9.93	4.32	8.39	7.25	565 18 0	134 2 0	17 2 0	234 2 0	29 16 0
140	17.51	10.01	17.84	8.41	28.76	11.76	1.53	3.98	0.24	193 5 0	506 15 0	28 8 0	606 15 0	34 0 0
141	15.21	8.50	22.62	14.69	9.65	19.83	4.03	5.47	0.99	158 5 0	541 15 0	23 18 0	641 15 0	28 6 0
142	9.95	8.41	11.65	29.27	24.09	10.57	—	6.06	0.67	242 8 0	457 12 0	39 6 0	557 12 0	47 16 0
143	13.70	7.84	12.00	38.80	8.58	15.27	0.10	3.71	0.51	299 3 0	400 17 0	33 8 0	500 17 0	41 14 0
Average for 1856,	16.05	11.04	16.93	16.29	17.75	13.38	3.50	5.03	1.13			£33 10 0		£44 8 0

In examining these Tables, we are at once struck by the extreme variations in the composition of this manure, which is so great that the averages given are really of little use, except to make evident the gradual improvement which has occurred during the last five years. They show also that the price paid for the soluble phosphates has varied from about £15 per ton up to more than £150, so that the buyer of a superphosphate may occasionally pay for that substance ten times as much as it is at other times to be obtained for. Amidst these variable numbers it is extremely difficult to determine the price which should be accepted as the average. Confining our attention to the present year, and assuming the price of superphosphate, good, bad, and indifferent, to average £7 per ton, it then appears that the cost of the soluble phosphates must have averaged £36, 12s. But in forming this estimate there are included a considerable number of samples of very inferior quality, and by simply omiting those containing less than 8 per cent of soluble phosphates, the price is reduced to £33, 10s. But the fair market-value of any substance is not to be deduced from the average of all the samples, but only from that of the best. The manufacturers who supply a superphosphate containing 20, 25, or 30 per cent of soluble phosphates at the price of £8 per ton, at which rate such samples are sold, must be supposed to do so at a profit, and it is they who practically fix the price of that ingredient. One sample in the table contains the enormous quantity of 42 per cent soluble phosphates, which the manufacturer actually sold at the rate of £17, 2s. per ton, for the superphosphate was offered at £8 per ton. It would be unfair, however, to estimate soluble phosphates generally at so low a price, because it is not likely that an article could be invariably produced containing them in such abundance, and it is probable that the superiority is due rather to a fortunate purchase of raw material than to any peculiarity in the mode of manufacture. But we may advantageously select the highest qualities as the measure of the price of the soluble phosphates. Recurring to the analyses made during 1856, which are 59 in number, we find that 29 contained more than 15 per cent soluble phosphates, 23 more than 17, and 19 more than 19 per cent. In the latter, soluble phosphates cost, on an average, £26, 12s., supposing the superphosphate to be sold at £8 per ton. I think, however, that the value which ought to be fixed for soluble phosphate should not be quite so low as this, and I would propose £28 per ton as that which ought to be adopted, as a fair average deduced from all the samples of the year 1856.

It will be observed by those who have paid attention to the subject, that this estimate is considerably lower than that hitherto adopted. Rather more than two years ago, when writing upon this

matter in the *Transactions*, I assumed £35 per ton as the price most in accordance with the composition of superphosphate. A year ago Professor Way fixed it at £32; while now we find that £28 is a fair estimate, from the article delivered to the consumers in Scotland during the present year. This latter price, I repeat, includes the cost of the sulphuric acid and sulphate of lime, and if these are to be separately estimated, the price to be assumed for the soluble phosphates should not exceed £25 per ton.

Some chemists calculate also the value of organic matters at the rate of £1 per ton in all manures. This I have never done, because it appears to me that farmyard manure will always be the source from which these substances are obtained most conveniently, in largest quantity, and at the cheapest rate. In fact, if we calculate the value of that substance on the principles followed for artificial manuring, excluding organic matter, we find it to be worth about 11s. per ton. Now, I believe it is usual to calculate its price at 5s. per ton, so that it is obviously the cheapest of all manures; and even if we take 10s. as its cost, it follows that we obtain organic matter for nothing in this form.

The great improvement in the quality of superphosphate during the past year is especially worthy of notice. Indeed, there has been a steady advance for some years back, both on the quality and the consumption. When I first became connected with the Highland Society, samples of superphosphate were very rarely sent to the Laboratory for analysis, and they were generally of the most inferior quality and frequently contained no soluble phosphates. But with every year there has been an improvement, until, during the year 1856, we see, by the average at the end of the table, the chances are that the purchaser obtains an article containing almost exactly 17 per cent of soluble phosphates. Great credit is due to the manufacturers, who have so greatly improved and cheapened their product, thereby conferring great benefits on agriculture. But it is quite possible that, by continued exertion, a still greater improvement may be effected. Indeed, we see that one sample has been produced containing no less than 42 per cent soluble phosphates, and which, calculated according to the prices now recommended, is worth about £13 per ton, in place of £8, the price at which it is sold. The secret of the improvement in this manufacture lies in the use of superior raw materials. Some years since, coprolites containing 50 per cent of phosphates were most commonly employed, and a small quantity of sulphuric acid added, but now bones and bone-ash, and spent animal-charcoal, are the principal materials; and as the two latter substances contain from 70 to as much as 80 per cent of phosphates, the consequence is, that when a sufficiency of sulphuric acid is used, a proportionately large quantity of soluble phosphates is obtained.

The result of the continued diminution in the cost of superphosphates consequent upon the improvement in its quality occurring simultaneously with the rise in price of guano, has materially affected the consumption of the latter manure in Scotland; and I believe that at the present time it does not exceed two-thirds of what it was two years since. The fact is, that a *good* superphosphate is now a much cheaper manure than Peruvian guano; and if the manufacturers go on improving, they will soon cause a diminution in the price of that substance. At the same time, it cannot be altogether dispensed with, as it is the most convenient form in which ammonia can at present be obtained. But if the price of sulphate of ammonia were to recede to £12 per ton, at which it could be bought five or six years since, Peruvian guano, *at its present price*, would be driven out of the field.

ON THE AGRICULTURE OF CANADA AND UNITED STATES.

By Mr ROBERT RUSSELL, Kilwhiss, Fifeshire.

An Address delivered at the Monthly Meeting of the Society, 28th January 1857.

THE task set before me of attempting to give, within the compass of one short address, an outline of the Agriculture of the United States and Canada, is (you may readily imagine) one of no little difficulty. In truth, I would have despaired of being able to go over so vast a subject in so short a time, and in a manner at all intelligible, without the assistance of a rough map which I have sketched for this lecture. As this, so far as I know, is the first attempt that has been made to delineate the regions of America best suited to the various crops, the map can have no pretensions to minute accuracy. Nevertheless it will, I trust, give a sufficiently correct bird's-eye view of the various agricultural districts into which the country may be divided.

Before visiting America, I had very indefinite ideas respecting the agricultural capabilities of the country, and perhaps I cannot do better than endeavour to present you with what information I may now have, somewhat in the order in which I acquired it.

You are all well aware of the intimate connection between Geology and Agriculture: hence, in travelling over a strange country, the first thing one must turn his attention to, is to get a knowledge of its geology; for as soon as this is mastered, and you know the lithological character of the rocks, you will begin to be more at home. With great interest you will then often notice how, on soils formed from the debris of the same geological strata, similar natural vegetation is repeated over great areas. Happily the geology both of Canada and the United States has been investigated by most competent men. From the fruits of their labours, and from the returns of the census commissioners, any one who travels over that vast country has every facility afforded him for studying the connection between Geology and Agriculture.

Our own eloquent historian of America, Dr Robertson, in referring to the mountains, the lakes, and the rivers of the New World, has said, "Nature seems here to have carried on her operations upon a larger scale, and with a bolder hand, and to have distinguished the features of this country by a peculiar magnificence." And sure I am that the same scale of magnitude will be found to prevail in the geological formations. In illustration of this, I may mention that one of the coal basins of North America is larger than the whole of England. In some instances, also, geological formations, having a great uniformity in their lithological charac-

ters, with corresponding uniformity in the character of the soils that rest upon them, extend over areas larger than Great Britain. Indeed, to have given you an address on the connection between the geology and agriculture of Britain would have cost me more labour; and from the want of agricultural statistics in the southern half of the kingdom, it would have been necessarily less definite. Within the limited area of Britain we have an epitome of the various beds which indicate the revolutions that the earth has undergone, and from which geologists are deciphering her history, and agriculturists are tracing the sources whence the materials of their soils have been derived. The manner in which the various strata are sometimes huddled together in our little island, as well as the agents to which they have been subjected, render the connection between geology and agriculture less easily traced. But the gigantic grouping of the materials that compose the earth's crust in North America, serves greatly to aid us in our task.

The first group of American soils to which I shall call your attention, is that which lies betwixt Long Island and the St Lawrence. This group rests upon the primary rocks—chiefly granite and gneiss. It embraces the north-east corner of the State of New York, and nearly the whole of the New England States—*i.e.* Connecticut, Massachusetts, Rhode Island, Vermont, New Hampshire, and Maine—besides the half of New Brunswick and Nova Scotia. It covers an area nearly as large as that of Great Britain and Ireland.

A very large portion of the surface of this primary formation is as rocky and mountainous as that of our Highlands. Instead, however, of the unreclaimed land having a carpet of grasses like our hills, or the prairies of the Western States, it is covered, all below the elevation of 4000 feet, with dense forests of broad-leaved trees, under which no grasses grow. I travelled several hundreds of miles through this picturesque country, and was everywhere astonished at the general poverty of the land. With the exception of some patches of rich alluvial land in the valleys, the soil over this granitic region is sandy or gravelly. On the uplands I don't think that I saw a field of 15 acres in extent which did not contain large numbers of boulders on the surface. I saw hundreds of acres in cultivation in New England, and Mr Horace Greeley assured me there were thousands over which one might almost step from one large boulder to another, and never touch the soil. There did not appear to be one-tenth part of the improved or reclaimed land under crops, as pasture seems to pay better. Very little wheat is raised in this region — the principal crops being potatoes, Indian-corn, and oats. It is rather out of the question to talk, as is frequently done, about these soils having been exhausted, for the truth is, there never was much to exhaust.

These primary soils north of Long Island, and south of the St Lawrence, cover an area little short of 100,000 square miles, or 64,000,000 acres. Large as is this area, it is small in comparison with the immense extension of primary rocks in the British possessions north of the St Lawrence and the lakes. Sir W. E. Logan, the well-known Canadian geologist, and the United States geologists, have pretty accurately traced out the southern boundary-line of this granitic region for a distance of about 2000 miles. From the 100th longitude and 44th latitude, it takes an easterly direction through Minnesota and Wisconsin, and, crossing into Upper Canada at the south-east corner of Lake Superior, it follows the north shore of the Georgian Bay, then, running almost due east, touches the St Lawrence a little below Kingston: from this point it retires a short distance from the river as far down as forty miles below Quebec, and then the north shore of the river and Gulf of St Lawrence lead out this boundary line to the Labrador coast. The distance to which this primary formation stretches towards the north has not been ascertained; but, according to Mackenzie the traveller, the shores of Hudson Bay are formed of the same materials.

Throughout these primary formations in the British Possessions, the soil, according to all accounts, as well as from what I saw of it, is as poor as in the New England States. The fertile land of Canada, you will thus readily perceive, must be greatly circumscribed by the predominance of the granitic formations. Indeed, the only soils which have any claim to be considered naturally fertile in Canada are those which rest upon the secondary formations. In Lower Canada these formations are hemmed in by the granite on both sides. From Kingston to the mouth of the St Lawrence the narrow strips of secondary rocks, taking in both sides of the river, nowhere measure more than 50 miles in breadth, and their average breadth is not one half of this.

The Trenton limestone, a member of the lower silurian, which is only somewhat sparingly developed, is the most friendly to vegetation, for it seems to sweeten the soil wherever it prevails. But there is only a comparatively small area of land of good natural fertility in Lower Canada. The limestone soils seem to pay better under pasture, than cropping them to a great extent. Opposite Montreal, the flats of the St Lawrence, consisting of a poor cream-coloured clay, are about 9 miles in breadth, and extend a considerable way down the river.

The state of subdivision of land in Lower Canada is not favourable to productive farming. Being originally a French colony, the greater part of the land is in possession of the descendants of the French. The farm-houses are either built along the river sides, or on both sides of the roads or "concessions." The farms are frequently not more than 40 yards in breadth, though upwards of a

mile in length. The farm-houses thus line the road-sides so thickly that they have the appearance of long straggling villages, some of them being upwards of 30 miles in length. Under such a defective system of agriculture, Lower Canada is producing much less than it formerly did.

I may mention that little or no autumn wheat is raised in the valley of the St Lawrence. The physical condition of the soil in America, in consequence of the extreme climate, has a much greater influence than it has in Britain. The same thing holds with respect to New Brunswick, where spring wheat is alone grown.

The area capable of growing autumn wheat in America is not a large one, as the soil requires to be of a particular description. The best wheat region west of the Alleghanies lies between the 41st and 44th parallel of latitude. Beginning at the higher latitude at Kingston, and in the lower south from the east shore of Lake Ontario, it stretches westwards into the territory of Minnesota and the State of Iowa. This region must be regarded as the northern portion of the vast plateau of the Mississippi valley. This plateau comprehends the north-west parts of the State of New York and of Pennsylvania, all the productive lands of Canada West, and of Michigan, a great part of the States of Wisconsin, Iowa, Missouri, and Kentucky, besides the whole of the States of Illinois, Indiana, and Ohio. This surface is mostly drained by the Ohio and Mississippi rivers, and is from 700 to 900 feet above the level of the sea. In length it is about 800 miles, or as far as from Edinburgh to Bordeaux, and in breadth about 600 miles; even the table-land has an easy slope of about a foot to a mile on both sides of the Mississippi towards the Gulf of Mexico.

Professor Twitchell, of Cincinnati Observatory, assured me that there was not a difference of 100 feet betwixt the spot upon which the observatory was built and any part of the country due northwards to Lake Erie, and that it was almost as level right west to St Louis, a distance of 360 miles.

One feature of this table-land is worthy of observation. The Ohio, Missouri, and Mississippi, as well as several of the other large rivers, have cut for themselves deep channels out of its horizontal strata. The consequence is, that the banks of these large rivers are everywhere somewhat precipitous, and the action of the side-streams has had the effect of breaking the country in their vicinity into a series of rounded hills or hillocks. The table-land at Cincinnati, for example, is about 800 feet above the level of the sea, while the Ohio there is only 400 feet; and thus the river is closed in on both sides by hills or banks about 400 feet in height. It is upon these hills, in the neighbourhood of Cincinnati, that the culture of the grape is extending so rapidly.

The geological strata over this vast table-land are nearly horizontal. The sandstones, shales, and limestones of the upper

silurian, the carboniferous limestone, and the coal-measures, divide this plateau amongst them. Time will not permit me to descend to particulars. There are elements, too, that have exercised a great influence in disturbing the connection between the nature of the underlying rocks and the nature of the soils.

Shortly after landing at Boston, I had the pleasure of an interview with Agassiz. In running over the map of North America, and giving me an outline of the agricultural geology, he said "You must bear in mind that the underlying rocks, in all parts of the country over which you propose to travel, is one vast polished surface as far south as Cincinnati." The same agents that have polished the rocks have broken up many of them, and ground them into gravels and sands. Indeed, sands, gravels, and other drift-materials, cover the larger portion of this table-land as far south as the Ohio; and, unless along the margins of some of the rivers, I saw very little land in the Western States, or Canada, that impressed me as being of great natural fertility. There was none that had the appearance of being so enduring in fertility as some of the trap-loams in Fife and in the Lothians. But I had not gone far over the wheat region of North America, before I was led to suspect that the peculiarities of the American climate have a great influence in modifying the ideas which we entertain respecting the qualities of land best suited for wheat.

You have heard of the valley of the Genesee being a fine wheat region, and so it really is. But a large portion of Genesee soils would not be envied by a Scotch farmer. What is called the valley of the Genesee, does not consist of a fine level *strath* of rich land, but is a part of the vast plateau that stretches into the valley of the Mississippi. Its surface is undulating, and covered with sands, gravels, and boulder-clay. I drove through the township of Caledonia, and found the soil as stony and gravelly, and of as thin a mould, as the twenty-shillings-an-acre soils resting on the northern gravel-drifts in Fife or Forfar. Yet these limestone gravels in the Genesee district are so genial to the growth of wheat and red clover, that these two crops are grown alternately. Thus wheat and red clover is the common rotation in the Genesee valley. You can easily imagine the crops of wheat will vary on such light land. Under good cultivation the yield of wheat is from 18 to 30 bushels to the acre. Caledonia township, chiefly settled by Scotchmen, is particularly stony, and in some parts the borders of the fields have a pretty wide space round and round piled up with gravel stones. Yet on such light gravelly soils the appearance of the red clover layers was universally fine.

I also visited the township of Riga, west from Rochester, where the soil consists of a light sandy loam, very genial to the growth of wheat and red clover in alternate years. The

mould is deeper than in Caledonia, and particular fields sometimes produce 50 bushels to the acre. These soils had no indications of being particularly rich, so far as one could judge by the eye, but the most of the farmers have nearly one half of their arable lands in wheat every year. The farmers in this part of America have a portion of their lands in timber for providing them with fuel, and generally a field or two in permanent pasture; yet it is quite common, in the Genesee district, to have one third of the holding sown with wheat.

It is evident that the productive powers of a district for raising wheat depend quite as much upon the frequency with which wheat crops can be repeated as upon the larger crops that can only be obtained at longer intervals. The wheat-exporting districts in America are confined to particular parts, which yield what we would consider small crops, but these crops can be had every other year.

The granitic soils, on the other hand, soon become too loose for wheat, which is little grown on these unless the land has rested in pasture. The Agricultural Statistics furnish some curious results when we contrast the quantity of wheat grown on the granitic soils of the seaboard with that on the limestone gravels and sands of the Genesee valley. Thus the township of Riga, having an area of 36 square miles, or 23,040 acres, produced more wheat in 1850 than the State of Massachusetts with its 4,992,000 acres. The county of Monroe, of which Rochester is the capital, having an area of 720 miles, or 460,800 acres, produced in the same year 1,441,655 bushels of wheat, a quantity larger than was produced over the whole New England States, or even the whole of the 64,000,000 acres of primary soils between Long Island and the St Lawrence.

Many of these light gravelly lands in the Genesee districts have been from twenty to forty years in cultivation, and I have heard some good authorities say that under proper management they are still as productive as ever they were.

The limestone gravels of the Genesee district are almost as genial to the growth of red clover as some of our best soils are to the growth of grasses. I heard no complaints of clover sickness in that district, but gypsum has almost everywhere a great influence in increasing its vigour.

No doubt the productive qualities of the American light lands for the growth of wheat are owing to their remarkable adaptation for bearing clover, but it soon became evident to me that wheat can be more easily raised on secondary lands in America than in Scotland. The best wheat-lands in America are of a sandy or gravelly nature; wheat is apt to grow too rank and luxuriant on rich soils, which are invariably planted with Indian-corn. The very fact of wheat growing too luxuriant on rich soils is of itself

sufficient to demonstrate that it can be easier raised upon secondary soils than with us. If you will just consider for a moment the peculiarities of the climate of Scotland and of America, the explanation of the phenomena is not difficult.

The American farmers sow their wheat on their light lands very early in autumn; and, before the frosts set in, the plants are thickly matted over the ground. Scotch farmers, on the other hand, look upon wheat that is thick and forward in autumn, on light soils, as little else than ruined; they are induced to sow late for the purpose of obtaining growth in summer, because, among other reasons, it is found that all plants that are forced early forward in our cold springs require a much larger quantity of manure. But again, the American farmer falls back upon autumn growth for the production of wheat, on the same principle that you would fall back on summer and autumn growth for the production of a crop of turnip seed. This is a fine illustration of Liebig's law, that time is equivalent to manure (ammonia and carbonic acid). A modification of the same principle, I hold, is the only consistent explanation of the Lois Weedon wheat experiments. At Lois Weedon the extra cultivation which the land receives is contingent to success; on the American light soils it is not. The winters are very cold in America, and spring can hardly be said to exist; for vegetation is completely kept in check till May, when summer bursts out at once. During the season in which the wheat grows, the rains, according to Dr Dwight, principally fall in thunder-showers with a hot and moist atmosphere. Under such conditions you can easily perceive that vegetation will advance with vigour, and that less manure (ammonia) is required to grow a certain number of bushels of wheat in Canada than in Scotland. Just contrast the fervid weather of May and June in Canada, with the lukewarm weather of the same months in Scotland, and you cannot fail to recognise the elements that render the maxims of the Canadian farmer very different, with respect to raising wheat, from our own. It would require a good deal of time to analyse these peculiarities by giving thermometrical figures; but I cannot resist quoting the language of the eloquent Volney, with respect to the total suspension of vegetation in winter and spring, and its rapid advance in summer.

It is not till May (says Volney), even in the latitudes 36° and 37° that the forest becomes green; a delay the more surprising, as the sun's rays are insufferably hot towards the last of April, and the difference in seasons between Virginia and Canada is not more than ten days, for the leaves are unfolded at Quebec by the 15th May, only twenty-five days after *breaking-up*. The change is so great that it seems as if a carpet of verdure was suddenly spread out on a floor 800 miles in extent. Hence it is that, as travellers have often observed, the United States know no spring; the transition is immediate from severe cold to scorching heat, and the

incongruous assemblage is constantly seen, of a freezing wind and a burning sun, a wintry landscape and a summer sky.

When at length vegetation receives a start, its progress is extremely rapid. Blossoms are quickly followed by fruit, and fruit reaches maturity much more speedily than with us.*

To show you the influence of this rapid increase of temperature on the wheat plant, I may mention that, so far as I could learn, the common varieties of winter wheat cannot be sown in spring in any part of America. When they are sown at this season, they have no tendency to seed that year. The spring wheat that I saw in America was chiefly a red-awned variety, very similar in appearance to our April wheat.

But many of you will, no doubt, wonder how the land can be kept clean in the Genesee district under a rotation of wheat and clover without any fallow crop intervening; nevertheless, under good management it can be so. The clover fields, which are to be sown with wheat in autumn, are broken up by a deep furrow in June and July. By this means the roots of the perennial weeds are subjected to the broiling heats of those months, and the surface is repeatedly scarified during the dry intervals of the weather. These operations have the effect of destroying most of the weeds. This economical system of management pursued in the Genesee district is gradually extending throughout the Western States and Canada, wherever the soil is similar in its nature.

Perhaps the spirit of farming in the Genesee district will be best illustrated by the mode of letting land. Mr Wadsworth's estate, which I visited, consists of 30,000 acres—only a small portion of which he farms himself. The common rent for the uplands is 8 bushels of wheat, *but no rent is paid for the clover lands.* To plough down the clover may look a very wasteful practice; yet when you look into the practical economy of the Genesee farming, it is difficult to say how, in the mean time, they could follow a better system.

The size of the farms in the Genesee country is usually from 100 to 300 acres. A large portion of the land is well cultivated. I may mention that the agricultural horses in this district are a fine race of animals—such, indeed, as any of our noblemen would consider suitable for their carriages.

As one travels to the westward, through Upper Canada, Ohio, and Michigan, great stretches of sands and gravels are found; very seldom, however, approaching to the character of rich loams. These form the soils best adapted for wheat. The country having been settled more recently, there are few districts where the farming has assumed the systematic culture that prevails in the Genesee country. Throughout the wheat region the summer climate is very similar as to temperature and rains.

* VOLNEY, *View*, Chapter ix.

The prairie country forms a great feature in the American continent. A line drawn from the centre of Southern Michigan to St Louis, and extending to Texas, would form a rough boundary betwixt the wooded and the treeless country; for west of this line the timber is generally very stunted, unless along the margins of the rivers; whereas the Atlantic board, for 600 miles inland, was everywhere densely clothed with timber when it was discovered by Europeans.

The surface of the prairies is undulating, somewhat resembling that of our northern drifts. The greater part of it is dry, and may be ploughed at once. I believe that the prairies of Indiana and Illinois are more destitute of timber than any part of the prairie region. This want of timber has been the chief obstacle to Europeans settling upon them. At the present moment the great streams of emigrants from Europe are flowing into the States of Iowa and Wisconsin and the territory of Minnesota. In these parts, land on which prairie and woodland are intermixed can still be got at the government price.

The prairies are covered with a vegetable mould, from a foot to a foot and a half in depth, which is evidently an accumulation arising from the decay of the natural grasses. This mould varies much in fertility, according to the character of the subsoil. Some of it inclines to a peaty nature. I saw prairie land that had borne twelve crops of oats in succession, and the last one had been rather too luxuriant. Indian-corn can also be raised for many years in succession in these soils.

Owing to the loose nature of the prairie soils, they are not well adapted for the growth of winter wheat. This crop is pretty sure for a year or two when the land is first broken up, as the roots of the wheat fix themselves among the decaying roots of the grasses and shrubby plants; but after the prairie soils have been cultivated for some time, the young plants are very liable to be destroyed in winter. Spring wheat is now principally cultivated. The prairie regions, if I mistake not, will prove most productive for grain. They are not so for pasturage. The dry improved prairie-lands sown down with timothy will not yield more than a ton of hay to the acre; but the same soils under tillage will yield 6 quarters of oats or Indian-corn for many years in succession.

There are no perennial weeds as yet in the prairies, which renders them easily cultivated. A Yankee farmer, who had settled in the prairies of Illinois, maintained that he would, with some assistance in harvesting the cereals, manage 100 acres of grain crops—wheat, oats, and Indian-corn—and save a quantity of hay besides. This may be a little overstated, but in some instances I found one man and a pair of horses managing 25 acres of Indian-corn, and 40 acres of oats and wheat.

The next agricultural zone into which I have divided the Mississippi valley, lies between the 39th and 41st parallels of latitude. In this belt it is very common for wheat and Indian-corn to be raised alternately. This corresponds to the Indian-corn region in the south of France, which was so much extolled by Arthur Young.* Indian-corn yields abundantly both in the north-west part of the State of New York, and in Canada West, but it is raised very sparingly on the wheat soils of those regions. One day I happened to meet a farmer at a railway station in the Genesee district, and on asking him why so little Indian corn was raised on the wheat soils there in comparison to Ohio?—"I don't exactly know," was his reply, "but a man and a boy will manage 50 acres of corn as easily in Ohio as they will do 5 acres on the wheat soils of this district." I afterwards found that there was a great deal of truth in this statement. A full discussion of this point, which my time will not permit, would explain certain results brought out by the agricultural statistics.† For example, both the Canadas produced little more than 2 million bushels of Indian-corn (2,029,544) in 1850, whereas there are some counties in Ohio which produce as much. The county of Sangamon, in Illinois, having an area of 750 square miles, furnished returns for about three and a third millions of bushels (3,318,304). The Canadian farmers spoke of Indian-corn being a valuable crop, but all complained of the expense of raising it.

On the 20th October, when I was about 100 miles south of Lake

* The most singular circumstance in the preceding minutes, is the infinite importance of the culture of maize. From Calais to Creissensac, in Quercy, you never once quit fallows: but no sooner do you enter the climate of maize, than fallows are abandoned, except on the poorest soils. This is very curious. Till you meet maize, very rich soils are fallowed, but never after: perhaps it is the most important plant that can be introduced into the agriculture of any country, if the climate will suit it. It is planted in squares or rows so far asunder that all imaginable tillage may be given between them; and the ground, thus cleaned and prepared at the will of the farmer, is an invaluable circumstance; and finally, it is succeeded by wheat. —YOUNG'S *Travels*, vol. ii. p. 140.

† In a very well written article in the December number of the *Genesee Farmer*, published at Rochester, the editor, my friend Mr Harris, has freely criticised some statements which I made in my article on "Agricultural Meteorology and Physiology" (which appeared in the July number of the *Journal of Agriculture*.) respecting the productive powers of wheat and Indian-corn in America. To these criticisms I shall take an early opportunity of replying. I am just as much interested in the questions which he has taken up as he professes to be, and shall be glad to discuss them with him. The fact that little Indian-corn is raised on the wheat soils in the neighbourhood of Rochester had fully attracted my attention. In my "Notes on Ohio and Michigan" that appeared in the last number of the Journal, I pointed out that there is more Indian-corn raised on the light lands of Michigan than on similar soils in the same latitudes, north and south of Lake Ontario. Perhaps Mr Harris will, in the mean time, be so good as explain why Indian-corn is grown so largely on the wheat soils of central Ohio, and why so sparingly on those of New York State. Does Indian-corn *destroy* more ammonia at Rochester than at Columbus, Ohio? Mr Harris, it may be mentioned, is a zealous advocate of the Rothamsted doctrines. Mr Lawes and he had formerly some correspondence regarding statements made by me on the same subject several years ago.

Erie, in the State of Ohio, I found that the light sandy soils upon which Indian-corn had grown were sown with wheat, which was finely brairded. In general, the Indian-corn was just put up in round stooks or "shucks," without being tied, unless slightly at the top. The land was beautifully clean, and the wheat had only been grubbed in, or in many cases only harrowed in. In this region, a bushel of Indian-corn is usually only one half the price of a bushel of wheat. Mr Uhl, of Ypsilanti, Michigan, told me that the wheat soils in the Genesee district, when planted with Indian-corn, did not pay any rent. On the other hand, I believe ordinary land in this region is worth as much in Indian-corn as in wheat. In the rich lands of the Scioto Valley, in the neighbourhood of Columbus, Ohio, the rent is 20 bushels of Indian-corn an acre, and only 7 of wheat, which is a pretty good criterion of the comparative productiveness of the two kinds of grain in this region.

Farther south, again, between the parallels of 39° and 35°, is the region best suited for Indian-corn. This embraces the southern parts of Ohio, Indiana, and Illinois, as well as a considerable portion of Kentucky and Tennessee. The soils in this region are chiefly derived from the limestone formations, and are the most fertile in the United States. The climate here is still more propitious for Indian-corn, but less so for wheat. Some of the farmers say that if wheat is forced beyond 25 bushels an acre, it almost always blights. On the best descriptions of soils, where Indian-corn yields 75 bushels to the acre, wheat only yields 18 bushels. As many as 166 bushels of Indian-corn have been gathered from an acre of land in Kentucky. It is curious, however, that the productive powers of Indian corn decrease very rapidly south of Tennessee. On the richest sugar-lands on the Mississippi, in latitude 30°, this crop rarely reaches 40 bushels to the acre.

The fact, however, of the best Indian-corn region being also the best grass region, is one that I was not prepared for. Nevertheless, such is the case. The great majority of the high-priced short-horned stock that have been exported from England have gone to this region. The rearing of cattle, horses, and mules is largely followed. The circumstance of the Kentucky soils being so propitious to the growth of grass, renders their fertility easily restored when they are overcropped with grain. Unlike our own rich pastures, those of Kentucky are almost entirely made up of one grass, called the Blue Stem. The want of good grasses in the cotton-growing States is a serious one, for the soils there undergo rapid deterioration, and their fertility is difficult to restore.

I may here allude to some peculiarities in the constitution of Scotch and of American soils, which form the most difficult problems connected with the chemistry of agriculture. I often asked those State-geologists with whom I came in contact what were the particular qualities of the Kentucky soils, which rendered them so

famous for the growth of grass. Lieutenant Maury was of opinion that their grazing properties were owing to the limestone moulds being retentive of moisture. That this element is a most important one, I do not doubt, but I am not sure if it is the most important. A certain condition of soils which I would call chemical, evidently exercises a powerful influence in rendering different kinds of land adapted for different plants. I shall only touch upon one branch of the subject here, as it is one in which I was much interested in travelling through America.

In 1844 I read a paper before the Trafalgar Agricultural Society on the connection between the Geology and Agriculture of the north of Fifeshire. I then pointed out the existence of an element that has an extraordinary influence in deteriorating the quality of some of the soils in that district, as well as in many other parts of Scotland. It also exists, I believe, to a considerable extent, in England, though I am not aware of its having been particularly noticed by agricultural geologists.

In many parts of this country there are no two terms more in use among practical men to designate the quality of soils, than "sharp" and "deaf," but we have as yet got no chemical definition of these terms. Many of you know a "sharp" soil from a "deaf" one by the eye, and how much less nutritious grasses and green crops are that grow upon "deaf" soils, in comparison with those that grow upon "sharp." In general, "deaf" soils are owing to the compounds of iron being in particular states of oxidation. The protoxides of iron impart the dull brown colour to many of our soils, and render them not only poor, but most ungrateful. These oxides of iron, I hold, are not so positively as negatively bad, inasmuch as they only seem to act injuriously on plants, by interfering with the healthy functions of the roots of our cultivated plants, sealing or locking up the alkaline and earthy matters which are essential to their growth.

It is a singular fact that all the American soils are sharp, and entirely devoid of that dull brown tinge peculiar to our moory soils, which many of us regard with abhorrence. I have questioned some of our geologists who have travelled in foreign lands regarding this irony deposit in the soil; for it is not only a most interesting agricultural, but geological problem. The only geologist who has given a theory for its formation is Hugh Miller, and it is one in which, the more I have thought, the more I am inclined to concur.* He, in his "Old Red Sandstone," has assigned its presence as owing to the growth of heath. As to the existence of

* The soil on the higher grounds is moory and barren, a consequence, in great part, of a hard ferruginous pan, which interposes like a paved floor between the diluvium and the upper mould, and which prevents the roots of the vegetation from striking downwards into the tenacious subsoil. From its impervious character, too, it has the effect of rendering the surface a bog for one half the year, and an arid sun-baked

this irony deposit, I questioned Agassiz and all the other American geologists with whom I came in contact; and my attention was constantly directed to it in travelling over the country; but though I did see some spots of black sand on the hill of St Hilaire, in the neighbourhood of Montreal, I believe there are no soils in America that correspond to our deaf moory ones. It serves greatly to support the views of the author of the "Old Red Sandstone," on this question, when we reflect that there are no heaths in America, and there are no moory soils. Poor as the New England soils are for grain crops, there is something about them genial to vegetation. It was quite surprising to me to see the quantities of beautiful apples that the orchards were bearing, though the soils were the veriest types of sterility.

On the other hand, it is well known that the red loams are particularly genial to the plants we cultivate. The Londoners soon found out that the "red moulds" of East Lothian produced a superior quality of potatoes. Our red soils, as a general rule, are "sharp," and produce nutritive grasses and sound pastures. Liebig supposes that the fertility of the red soil arises from the peroxide of iron (to which their colour is due) absorbing ammonia. There is something, however, more than this. I suspect that our vegetable physiologists are at fault in supposing that plants absorb their food mechanically, along with water. The process is apparently a chemical one. The protoxides lock up the earthy matter necessary to the healthy growth of plants, while the peroxides, by being favourable to the healthy functions of the roots, have virtually a contrary effect. When we come to discuss the chemistry of poor Scottish soils, we shall find these questions on the threshold of that subject. Finger-and-toe in turnips, and some other diseases of plants, are apparently somewhat kindred in their character. The particular condition in which the vegetable matter exists in the soil interferes with the roots absorbing those substances, which are essential to their healthy growth. Lime, I am led to think, cures finger-and-toe, by correcting the particular de-

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waste for the other. It is not improbable that the heaths, which must have grown and decayed on these heights for many ages, may have been main agents in the formation of this pavement of barrenness. Of all plants they are said to contain the most iron. According to Fourcroy, a full twelfth part of the weight of oak, when dried, is owing to the presence of this almost universally diffused metal; and the proportion in our common heaths is still larger. It seems easy to conceive how that, as generation after generation withered on these heights, and were slowly resolved into a little mossy dust, the minute metallic particles which they had contained would be carried downwards by the rains through the lighter stratum of soil, till, reaching the impermeable platform of tenacious clay beneath, they would gradually accumulate there, and at length bind its upper layer, as is the nature of ferruginous oxide, into a continuous stony crust. Bog iron, and the clay ironstone so abundant in the coal-measures, and so extensively employed in our iron-works, seem to have owed their accumulation in layers and nodules to a somewhat similar process, through the agency of vegetation.—MILLER'S *Old Red Sandstone*, 2d edition, page 183.

composition which the vegetable matter is undergoing. So it is, perhaps, with the limestone moulds of Kentucky, promoting the healthy functions of the roots of the blue-stem grass. As we go south, we get out of the limestone region, and the country becomes very poor for pasture.

The next great agricultural division of America is that which is occupied by the ridges of the Alleghany Mountains, extending from New York State to Alabama. The elevation of this mountain chain varies from 2000 to 6000 feet in height. The country is broken and hilly, so that it is more suited for pasture than for cropping. Throughout its extent there are many transverse and longitudinal valleys, which are very productive, more especially in the limestone districts of Virginia and Pennsylvania.

The soils of New Jersey are generally poor and sandy. The counties of York and Lancaster in Pennsylvania, a little to the north of Philadelphia, rest upon the limestone rocks, and though these lands have been long in cultivation, they are still productive of wheat and red clover. The small States of Maryland and Delaware contain the richest lands on the Atlantic seaboard. The former is still very productive of wheat and tobacco. Virginia, which is about the size of England, is, on the whole, naturally a poor State.

By the map you will perceive that the wheat and Indian-corn producing districts leave the Atlantic seaboard in Virginia, and skirt, in a narrow belt, along the flanks of the Alleghanies through the Carolinas, Georgia, and Alabama. The increase of temperature in these Southern States renders the coast unsuited for the growth of wheat, and it is only after an elevation of 1000 feet is attained that this crop is cultivated to any extent; and the yield per acre even then is very small.

Along the coast, in the southern part of Virginia, the cotton plant is cultivated for domestic manufactures. In North Carolina it is raised for export, and in South Carolina, Georgia, Alabama, and Mississippi, it becomes the great agricultural staple.* In the United States there are now nearly 4,000,000 bales of cotton raised annually; and as the most competent authorities assured me that the quantity of cotton fibre would not, on the average, exceed 200 lb., or half a bale to the acre, there must be nearly 8,000,000 of acres of land annually under cotton. That the yield per acre is not greater than this, I could readily believe, as the most of the

* The Statistical Returns of 1850 give the number of bales (400 lb. each) for these States, as—

Virginia,	3,947	Mississippi,	484,293
North Carolina,	73,849	Louisiana,	178,737
South Carolina,	300,901	Texas,	57,596
Georgia,	499,091	Arkansas,	65,346
Florida,	45,131	Tennessee,	194,532
Alabama,	564,429	Kentucky,	758

cotton-lands of the Southern States are of no great natural fertility.

The cotton soils of the Carolinas, Georgia, and part of those of Alabama, rest upon the primary and tertiary formations. In general they consist of a sandy clay; and it is a curious fact, that the lithological characters of the soils derived from these two formations are very similar in appearance. The primary rocks in these regions have not been subjected to denudation as they have been in the north, for the gneiss and mica schists have, in many cases, decomposed *in situ* to great depths. The tertiary clays appeared to me to be a re-formation of the primary materials. A basin of cretaceous soils in Alabama affords the best cotton lands in the south. The post-tertiary soils of the Natchez uplands are also fine cotton-lands. But the most productive cotton-lands are along the banks of the Mississippi and its tributaries.

The larger portions of the upland cotton soils, however, are not by any means of great natural fertility. They are very subject to washing by the rains, and none of them bear good pastures, so that they are of little value when they are allowed to rest. The cotton-lands, for this reason, undergo rapid deterioration.

The cotton-plant is cultivated as an annual in the United States, as the frosts of winter kill it. But under the climatic conditions of the country, it is very productive of fibre. It requires a high summer temperature, and, like our cereals, it must have showers throughout the growing season, which extends from May till November.

It is a remarkable feature, influencing the agriculture of the lower latitudes of the American continent, that they are abundantly supplied by summer rains. On the other hand, it is almost rainless in summer betwixt the parallel of 18° and 40° in Africa and Europe. Hence no cotton or sugar-cane is grown unless the soil is irrigated. And throughout the same latitudes in the Atlantic, more especially about the 30th parallel, the sky at that season is generally without a cloud, and the sea is usually so calm that one might cross in an open boat from the African to the American continent. But as the American continent is reached, so is the region of storms and fertility. The West India Islands have their hurricanes and their luxuriant cane-fields—the Mississippi valley its summer tornadoes and its cotton and Indian-corn. From the Gulf of Mexico to our possessions in North America, the whole country is liberally watered by summer rains. There is no break in the vast rainy region. After fully considering Espy's theory of the trade-winds, and of the calms of Cancer, I am ready to admit that it is a most simple and beautiful addition to the science of meteorology. At the same time, I am persuaded that the nicely-adjusted forces which exist in the belt of high barometer in the Atlantic, do not exist on the American continent. The United States and Canada owe their fertility to the abnormal

course of the tropical winds. The aerial currents, hot and moist from the equatorial zone, after crossing the Caribbean Sea and Gulf of Mexico, flow northwards in summer over the continent, almost with the regularity of a monsoon. In this view, which I early adopted in investigating the laws that govern the climate of North America, I found that I had been so far anticipated by Volney. It now seems rather strange that this fundamental element in the climatology of the country has been so much overlooked. Sometimes one cannot help feeling provoked at the assurance of a certain school of meteorologists, who quote all manner of contradictory authorities, and who have entirely abandoned the discussion of the subject on strictly scientific grounds.

The productive land of the cotton region is greatly restricted by the post-tertiary formation that forms a broad fringe along the coasts of the Atlantic and Gulf of Mexico. From the southern part of Virginia to the extremity of Florida, and from this point northwards and westwards to the Mississippi, a distance of about 1700 miles, is a belt, varying from 100 to 150 miles in breadth, consisting of little else than loose sand. This vast extent of country is covered by the long-leaved pine, which is very similar in appearance to our Scotch fir of about 60 years' growth. This formation goes under the name of the Pine-Barrens, and I believe stretches into Texas.

The sea-island, or long staple variety of cotton, is cultivated along the coast from the 33d degree of latitude southwards, and to the distance of 20 miles inland. The soil is also very poor and sandy, and the produce per acre does not average more than 150 lb. The price, however, varies from 1s. to 3s. a pound, according to the care with which the seed has been selected, and its culture attended to. The mud of the salt marshes is largely used for manure, and by this means the fertility of the soil is maintained.

The rivers from the Alleghany Mountains have dug for themselves channels out of the loose materials that compose the pine-barrens. Along the rivers there are narrow strips of rich alluvial clay. On these rich lands rice is grown where the tides are fresh, and thus suited to irrigate the crop, and cotton or sugar where the land is embanked and under dry culture. The most of the sugar-cane, however, is raised on the rich bottom-lands of the Mississippi, as far up as the 31st degree of latitude. The soil capable of raising sugar in Louisiana is entirely confined to the banks of the river and its branches in the delta; and I believe that the land capable of raising it in this State is now nearly all taken up. To the westwards in Texas there are, it is said, a considerable extent of cane-lands. Florida also grows sugar-cane; but this is the poorest of the Southern States, and the alluvial soils along the rivers are of secondary quality.

The facilities that exist for transporting the produce from the

interior to the seaboard, are of great importance to American agriculture, and may now be shortly noticed. Beginning with the States south of Pennsylvania, the rivers are navigable for steamers as far as the primary or secondary formations, which are from 100 to 150 miles in a straight line from the coast. This, you will perceive, is of immense advantage for conveying the upland cotton to the shipping ports. The rivers that flow into the Gulf of Mexico are also navigable for a great way from their mouths. The Alabama is navigable for steamers through a winding course of 500 miles. The Mississippi and its tributaries have no loss than 25,000 miles navigable by steamers. The cotton and sugar are all sent down to New Orleans, and thence exported. The grain raised in the States north of the Ohio river finds its way eastwards to the Atlantic towns by canals or railways, or by the St Lawrence to Europe.

Canals and railways have already contributed a vast deal for advancing the interests of the Western States; the conveying of grain for any distance by waggons being out of the question. Indeed, the rapid rise of the western country is mainly owing to the improved means of communication. Lieut. Maury assured me that the first settlers on the Ohio only got one crop in two years. It took one year for them to raise it, and another to take it down to New Orleans on rafts, and return home across the country. I was introduced to a gentleman having a fine estate of 5000 acres on the Scioto, Ohio, who informed me that when he was at college, Indian-corn only brought from 2½d. to 3d. a bushel, and this was the only article the farmer could sell. For the ten years preceding the autumn of 1854 the average price of Indian-corn for the last ten years in Southern Indiana was from 8d. to 10d. a-bushel. Railways have now been opened, and raised the prices. The price of Indian-corn is still regulated by its value for feeding pigs, cattle, and mules. In all those districts that are not accessible to railways or canals, the bulk of the produce "travels to market on its own feet," in the shape of cattle and mules. In Southern Indiana and Illinois the most of the Indian-corn, oats, and sometimes a portion of the wheat, is what the farmers call "hogged down," and never gathered. Bacon, being a comparatively high-priced article, bears a much longer carriage.

The agricultural produce of the States north of the Ohio seeks its way by canals or railways to the lakes. In 1850 Illinois had 100 miles of canals communicating with the Lakes. At the same time Indiana had 600 miles, and Ohio 700. New York State had also then 900 miles of canals open. Freights are less upon the canals than on the rivers or the lakes. Some vessels have been freighted at Chicago, at the south end of Lake Michigan, and gone to Europe direct. The great bulk of the produce of the Western

States, however, is conveyed from Buffalo through the Erie canal to Albany on the Hudson, and thence to New York.

The Erie canal is 364 miles in length, and the cost of carrying a bushel of wheat this distance varies from 1s. to 1s. 6d. The country through which this canal passes is so level that there are two stretches of 70 miles without a lock.

The Pennsylvania canal, which connects the Susquehanna with the Ohio, has a break over which the barges are transported on a railway, but it opens up a channel for the conveyance of agricultural produce. It costs 10d. a-bushel to carry wheat from the centre of the State of Pennsylvania to Philadelphia. On the western borders of this State the price of wheat is often little more than the half of what it is on the seaboard. It takes from £4 to £5 a ton to transport wheat by railway from Cincinnati to the Atlantic towns.

It would be easy to show you that the prices of wheat can never rise very high along the lower Ohio until there is more local consumption. Were the prices of wheat to remain as high in the Atlantic States as they were in 1854 (8s. to 9s. a bushel), a great stimulus to the production of wheat in the Western States would be given, because this grain could no doubt be sown largely instead of Indian-corn. The difficulty that the American farmer has to contend with, is not so much the raising of grain as transporting it to market. The rise in the price of butcher-meat over the country encourages the feeding of stock, and the avoiding of the long carriage of a bulky article, which sometimes does not pay the cost of transportation when the prices fall on the seaboard. The wheat-exporting district is very limited on the seaboard, where the population is increasing very rapidly. Indeed, the most of the supplies for the larger towns are all drawn from the interior. Good prices, then, must be maintained in Europe, if we are to receive greatly increased quantities of grain from America. With the cotton crop it is different, for, being a high-priced article, it bears the expense of a long carriage. In the Southern States it is not uncommon for cotton to be conveyed 150 miles by waggons before it is put on board the steamers on the rivers. To transport wheat this distance by the same means would cost more than it was worth. For this reason the cotton crop, by balancing the exchanges with foreign countries, contributes more to the prosperity of the United States than any other.

I could not think of concluding without thanking Mr Hall Maxwell, our Secretary, for the letters of introduction to his agricultural friends in America, and of availing myself of this opportunity of expressing to him the obligations I am under to them, as well as many others with whom I came in contact, for the kindness and liberality which I experienced in travelling through the country.

VETERINARY DEPARTMENT.

Edited by John Gamgee,

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[The following observations contain the substance of communications made to the Society by Mr James Cowan, late Shepherd at Park, in Renfrewshire.]

I. ON LOUPING-ILL AMONG SHEEP.

The author says that the disease called *Louping-ill*, or *Trembling*, is very prevalent in the pastoral districts of the south of Scotland. It occurs, more or less severely, every year in Roxburgh, Selkirk, a part of Dumfries and Peeblesshire, extending likewise over large tracts of land in the north of England.

Louping-ill affects sheep at all ages; it is sometimes confined to ewes; at others, hoggs or year-old sheep are its victims; whereas lambs may suffer, and the older animals resist its attacks.

The symptoms are various, but nevertheless characteristic. In acute cases, an unsteady gait and excited appearance indicated by a peculiar brilliancy of the eyes, constitute the first indications of disorder. The affected animal separates itself from the rest, or follows the flock with difficulty, and is seized with fits. The premonitory signs are sometimes overlooked, and attention is first drawn to the ailing creature when it is convulsed, prostrate on the ground, and struggling; the animal dies in a few hours. The malady may be of slow progress; unusual dulness precedes the stage of excitement, when the shaking commences, and the fits follow, rendering death a matter of certainty, though life may be prolonged for some days.

Mr Cowan says that the *post-mortem* examinations, when the disease has been of short duration, reveals an inflamed state of the lungs; the stomach and bowels are not much affected, and the liver is so slightly; the brain is, in general, considerably congested. In animals that have borne up longer under the attack, the chest is found filled with water, or by a semi-fluid brown-coloured jelly; the liver is inflamed and enlarged, and the stomach and bowels are much disordered, though not exhibiting the appearances that would result from an acute inflammation. Shortly after death there is a formation of gas under the skin, outside the chest, behind the fore extremities. This same sign of incipient decomposition is apparent in braxy and other affections of the digestive organs.

The most casual observation is alone required to render it apparent that the disease consists in inflammation of the lungs.

Louping-ill occurs mostly about the months of April and May, sooner or later according to the character of the season and advanced state of the pasture. It occurs in animals that have subsisted exclusively, during the winter months, on the withered herbage and dry heath of the hills, so that, when the season is more favourable, the food is richer, and derangement follows. Under these circumstances, animals are peculiarly susceptible to suffer from sudden atmospheric changes. The disease, therefore, makes its appearance during shifting winds, cold showers, or warm days with frost at night. The nature of the pasture has a tendency to modify the character of the disease: thus, upon hill-lands, where lambs are apt to die after castration, and the older sheep from simple cuts received when being shorn, the louping-ill is usually very severe: this is particularly the case in some districts of Argyllshire.

If the stock be extremely reduced during a bad season, the year following is marked by an increase in the number of animals affected by louping-ill. On a large farm, in the parish of Ettrick, much loss was sustained among the sheep during the years of 1838 and 1839, following the very severe spring of 1837.

Louping-ill occurs on every variety of rock and soil within the districts subject to its attacks. Our author was informed by a farmer in Teviotdale, that, within the last ten or fifteen years, the malady has decreased, but it is not known from what cause.

The treatment recommended by Mr Cowan consists in bleeding at first; he recommends the exhibition of castor-oil and tartar emetic, and under all circumstances the sheep should be placed under cover. It is a highly reprehensible practice to "let the sheep alone, and just keep off them," not only because the ravages are great if the acute affection be not checked, but sick animals are apt to get injured by falling into burns, drains, or water-holes; and they lose power rapidly, so that they must be mercilessly left to perish, or be carried home when it is too late to effect anything by treatment.

When louping-ill has been allowed to run its course for some time, or has passed unobserved for some days, it is wrong to bleed, and the sheep must be sheltered, and perhaps purged, whereas warm gruel should be given to support the vital powers. If it be a ewe affected, with a lamb at her side, she cannot nourish the latter, as the secretion of the udder is stopped, and the poor animal is subject to constant suffering and discomfort from the young attempting to draw its usual supply; besides which the lamb itself may suffer and die, whereas the mother may eventually recover.

Mr Cowan mentions an experiment he instituted in 1845, to prove that it is essential to adopt some method of treatment in louping-ill. In the months of April and May of that year he had sixteen cases of louping-ill; eleven of them were sheltered, purged, and

supported with gruel, and three only of them died. The other five were simply sheltered, and the lambs removed from them late; and although they were, from the first, not more severely affected than under ordinary circumstances, still four of them lost their life. Of the eight treated, some presented more alarming symptoms than any of the four that died.

During certain seasons there is great mortality amongst the lambs, and they are not treated with so much success as older sheep. If in good condition, they die rapidly, the attack being only of a few hours' duration. They are not unfrequently seen playing in groups in the evening, and by next morning several are lying dead or dying. These lambs are generally from three to five weeks old, and are just beginning to eat a little grass, and, like old sheep, are peculiarly subject to louping-ill when there are sudden atmospheric changes, when the days are warm and nights frosty, when the wind quickly changes from south or west to east or north-east, and there is a rapid lowering of temperature.

Many lambs are at times lost on arable land, where older sheep are not so subject to the malady; and Mr Cowan has of late years observed in Renfrewshire that it is most prevalent upon rich lands, particularly in fields that have received an ample supply of manure for two or three years in succession. On the poorer soils and older lees the affection assumed the same character as on the hills of Selkirk and Roxburghshire, and the mortality was greatest in some peculiar field where, in previous years, no such disease occurred, and where, the year following, the loss would again be only trifling. This, says Mr Cowan, shows there is a combination of causes giving rise to the disease, such as the quality of pasture and atmospheric influences.

Several diseases of sheep are mistaken for louping-ill. The first mentioned is "thorter-ill," seen in the border counties, and which our author says may be called "an epilepsy." It is confined to young sheep, and is sometimes seen in lambs at birth. Thorter-ill is a disease of the nervous system, especially of the brain, and the sheep affected by it fall over when excited in the least, and struggle violently before they are able to rise, but when on their legs appear quite well. The fits of thorter-ill occur at distant intervals, and are more frequent as the malady advances; the sheep have either to be killed, or perish by accident. Thorter-ill is incurable.

A form of acute indigestion may be mistaken for louping-ill. It prevails amongst lambing ewes brought from the hills, or that have been driven a considerable distance, and put upon arable land and rich pasture. The affected animals swell, and a green liquid is discharged from the mouth and nostrils; their staggering gait leads to the supposition that they have louping-ill. Bleeding, a dose of salts or oil, mustard or ginger, and a little

turpentine, are the therapeutic means had recourse to with success. The best preventive is to place the new stock on comparatively poor land, or on grass that has been partly eaten.

There is a disease of sheep peculiar to hill-pasture, and occurring only in severe seasons that is spoken of as louping-ill. When heavy and long-continued snows have limited the supply of food, the ewes that are in lamb, especially those bearing twins, become constipated, acquire a staggering and unsteady gait, appear giddy, and, if not attended to, lose the strength of their limbs, at which stage their recovery is hopeless. When taken in time, they are easily cured by simple salts or castor-oil, and feeding them on gruel. When it is but a short time they have been affected, Mr Cowan has seen them quickly recover by being removed to young grass, or where they could get a bite of soft and richer food.

Two other affections are mentioned as being often called by the name of louping-ill: the first is the effusion of watery fluid around joints in ill-nourished lambs after a severe winter; the animals are rendered permanently lame, or one or more limbs may become paralysed. The next disease alluded to is rheumatism, characterised by swelling of the joints, and, under some circumstances, the heart participating in the disease. Sometimes, in louping-ill, the joints swell; but there is no relation between the latter and the two former maladies. In lambs that have been partially supported by cow's milk there is a tendency to effusion around the joints; and Mr Cowan believes that, unless under exceptional circumstances, when it may be absolutely necessary, cow's milk should not be given to lambs.

Our author says that the old adage that "prevention is better than cure" applies with full force to the diseases of sheep, on which he has written; and the whole secret of the preventive treatment is keeping the stock in uniformly good condition upon arable land; and although always on the same soil, and subject to changes of temperature, still they are exempt from its attacks. It is difficult to effect this with hill-stock that is so much at the mercy of the elements, exposed to all the consequences of stormy winters and late springs, during which all human efforts are of little avail in accomplishing the desired object spoken of above. There is much arable land along the beautiful pastoral vales in the south of Scotland that might be made to provide abundant food for sheep during the severe seasons of the year.

Although louping-ill will never be totally eradicated, according to Mr Cowan, as it depends on causes that are quite beyond human control, still much may be done to prevent it by artificially feeding hill-stock during the winter and spring seasons, and maintaining the animals, so far as circumstances will allow, in a uniformly good condition.

Though somewhat abridged in form, the substance of the essay

on louping-ill has been reproduced here that its real merits may be recognised. It is very true that several maladies receive the designation of "louping-ill" and "trembling," and that these terms are used in a very general rather than in a restricted sense. Veterinary nosology is very imperfect, and much confusion arises from the copious lists of vernacular synonymes for each disease, each designation being in itself vague and indefinite. There are many affections in which "trembling and convulsions" constitute leading if not characteristic symptoms, and febrile disorders are mostly ushered in by shivering fits, which vary in duration, and which sometimes recur at periodic intervals. Inflammation of the lungs in all animals is preceded by various premonitory signs, including rigors or violent trembling; but what is known to veterinarians as "trembling" or "louping-ill," so far as we are aware, is not simple inflammation of the respiratory organs, but a disease of the nervous system.

Mr Cowan is right in saying that the causes of louping-ill are such as tend to weaken the constitution. These causes have been well investigated by a French veterinarian, Roche Lubin, who, during fifteen years engaged in active practice, observed 467 cases of "trembling," called *tremblante* in French, and which is the true louping-ill of Scotland. Roche Lubin states the causes of louping-ill to be abuse of sexual intercourse by the rams, the frequent fighting amongst the latter, and any inordinate excitement, such as being run down savagely by dogs; loud claps of thunder; and in ewes that cannot be stinted, the incessant return of sexual desires lays the foundation for this nervous disorder. It has been observed after difficult lambing, or abortions in the early periods of gestation, after attacks of inflammation of the intestines, or after the sudden cure of old-standing cutaneous affections.

It is generally recognised as most common amongst high-bred sheep; nevertheless, high-bred animals in certain climates and special localities are quite free from its attacks. Change from imperfect winter-keep to highly nourishing diet doubtlessly influence its development. It is not, as was once supposed, a contagious disease.

There is no doubt that in Scotland the mortality amongst the sheep from louping-ill is most in the months of April and May; and it appears that the Cheviot sheep are more subject to it than Leicesters, or the black-faced breed of the Highlands. I have it on reliable authority that louping-ill is much more prevalent in certain localities than others, and as an example to be adduced is the pasture-land on either side of the Tweed. From Cardrona Mains to Melrose, on the south of the river, much of the stock perishes from attacks of the disease; whereas along the north bank of the Tweed, from Netherhouse opposite Cardrona Mains

down again to Melrose, but few cases of it occur annually; on some farms scarcely a sheep in the course of the year will be affected. Caberston, on the north side of the above-named river, is quite free from louping-ill; whereas on the farm of Bold and Juniper, to the south and opposite Caberston, the losses sustained every spring are very great.

The lesions that have frequently been observed in louping-ill are those of greater or less organic disease of the brain and spinal marrow, consisting in signs of congestion, or exhausted inflammation, or softening, especially in the region of the loins. Some authorities say that they have often failed to recognise any peculiar lesion. The emaciation and general signs of a debilitating and life-exhausting malady are present, more especially in chronic cases; and thus the fluid is found in the chest, as it is around and within the brain and spinal marrow, and the blood throughout the system appears watery. There are many intestinal worms and other parasites, as in all cases where the constitution suffers as in louping-ill.

We abstain from saying any more at present, as we trust to investigate the subject further, with a view to suggest something more definite than has hitherto been spoken of for the prevention of the disease. Evidently the mode of feeding should be attended to, the animals should be less exposed, less worried, and other causes tending to impoverish them should be counteracted with judgment.

So far as treatment is concerned, many persons are opposed to bleeding; but they suggest purging and the use of camphor, of turpentine, of cream of tartar, of setons and blisters, especially over the loins. If the bloodless weak state is induced, tonics should be used; and as worms are often found in the intestines, appropriate medicine should be exhibited. We shall next consider the Essay on—

II. STURDY IN SHEEP.

The definition of Sturdy, given by Mr Cowan, is as follows:—"A collection of water in the brain, enclosed in a bag or bags of a round or elongated form, varying in size from a pea to a small marble; the water has been discovered by scientific men to surround a parasite."

Our author continues to say that sturdy affects only young sheep, especially one and two year olds, the greater number being attacked from nine to eighteen months. Symptoms—Modified gait; the feet are lifted quickly and high; as the disease progresses, the head is uplifted, the eyes prominent, the animals are easily startled,

and, instead of running, progress by a succession of leaps. They now begin to wheel round in a circle, turning round on the same side that the brain is affected; sometimes partial, and often total blindness ensues. The bones of the skull become soft, and yield to the touch; they become pierced by absorption, by which time the sheep has become emaciated; it is attacked by convulsions, and dies.

There is no proof that sturdy occurs in damp pastures, and it occurs in the dry braes of Tweedside, as in the damp bogs of Eskdalemuir; it is as much known in the hard and heathery hills on the lower reaches of the Yarrow, as among the dank glens and misty cleughs of Ettrickhead and Tima.

Sturdy prevails more or less in the same place, at different seasons, without assignable cause; and it is as frequent now as ever. Mr Cowan thinks it is perhaps hereditary, or the result of bad nourishment, and exposure of lambs to cold; or, lastly, as the result of another disease.

In alluding to hereditary taint, it is shown how lambs born of diseased parents, whatever may be the malady affecting the latter, are more subject to many affections; and instances are adduced of the occurrence of thorter-ill in the offspring of sheep enfeebled by any disease, and especially rot, when flukes are found in the ducts of the liver.

To prove that ill-nursed lambs are very susceptible to attacks of sturdy, Mr Cowan points to the fact that the spring of 1837 was unusually cold and severe, stock upon hill-land was much reduced, and *palleys* (the smallest lambs are so called) abounded everywhere; farms, noted as peculiarly dry and sound, in Selkirkshire, and on which 800 sheep were kept, formed no exception; the lambs suffered, and were small and poor; and in the spring and summer following, out of seven score kept for stock, there were fifty sheep affected with sturdy. The winter of 1838 was likewise severe, and the spring following it cold; the hoggs, the produce of that year, fell victims to the disease, but not to such an extent as those of the previous season, and in succeeding years the malady almost disappeared.

Our author remarks that he has seen as many lambs, out of twelve or sixteen of the smallest, wintered on low land, affected with sturdy, as out of as many score of the best and strongest lambs, though wintered on the hills; and he has killed many palley lambs when about a year and a half or two years old, and he has found in them bladders of water contained in a *sac* in various parts of the chest and abdomen, and closely resembling the parasitical productions of the brain. It is not known if the first bore any relation to the latter, but they have been found in animals in the condition that is favourable to the development of sturdy,

and in those whose joints were swollen from attacks of rheumatism brought on by cold and starvation.

Sturdy, Mr Cowan believes to follow other diseases, and an attack of it is sometimes preceded by symptoms of louping-ill, which have, however, completely disappeared.

Under the head Treatment our author speaks of three different operations to relieve the animals. The first is by complete excision of the *sac* containing the water; the second is by simple piercing the skull where the bones have become soft, and allowing the fluid to flow out; and the third consists in wiring up the nose: the latter consists in passing a strong wire up the nostril on the affected side, straight through to where the bones of the skull are soft. Our author says this is a very successful plan, if performed by a skilful operator; and he has seen as many as four and five out of six cured by it. For success to attend any of these operations, it is important that the disease be not too far advanced; in which case, the brain is injured, and the animal much reduced. The disease should be fairly developed, but emaciation should not be marked. Instances occur of sheep affected with sturdy dashing their skull against a stone wall, or other resistant obstacle, and thereby the bag is burst, and evacuated of its contents, as completely, and often with the same results, as by a surgical operation.

To gain information relating to sturdy, queries were addressed to intelligent persons, and the answers received from one of them are to the effect that hoggs upon wet land are not more subject to sturdy than if on dry soil, but that the malady is most prevalent during wet seasons, with high westerly winds; also that it affects ill-nourished animals most; but it is hereditary, as it has been observed, most among the produce of dull tups with weak constitutions. Sturdy is more frequent in Fife than in other counties; and in referring to treatment, the person that furnished this information was of opinion that the wire was the best surgical instrument that he had ever seen tried.

The additional facts alluded to, in connection with sturdy, are that it is more frequently seen amongst lambs driven away to be reared far from the place of their birth, and it mostly affects lambs bred in the border counties and taken to Fife. Wether hoggs are more subject than ewe hoggs to sturdy; and however unaccountable the fact, still wethers are more troublesome during the winter than the ewes.

In appending remarks to the Essay on Sturdy, I feel that it is scarcely fair to criticise or develop any part of it; but, adding this to the general store of material, referring to giddiness in sheep, we must independently show how much light experiments by scientific men have thrown on this once obscure subject.

It has been asserted of old, that the shepherd's dog had some-

thing to do with the development of sturdy, and it was supposed that worry and fear induced the nervous disorder; but whereas of late sturdy has distinctly been traced to the dogs that accompany a flock, or live near it: it is not because the dogs worry the sheep, but because the parasite infesting the brain of the latter animal lives in another form in the intestine of the dog; and in the latter habitat myriads upon myriads of germs are developed, which, strewed on the pasture, or in pools, are taken into the stomach by the close-biting or thirsty sheep, and from the stomach find their way somehow into the blood-vessels, and thence to the brain.

There are many species belonging to the genus Tænia, or tape-worm, and there are many forms of so-called "cystic worms," or parasites enclosed in bladders. A cystic worm, such as the hydatid of the brain of the sheep (*Cœnurus cerebralis*), is but a phasis of a tapeworm, in a habitat unfit for its full development. It is but a transitory state from the simple primary germ to the full form of a tænia; and what is more remarkable is, that there are several transitory conditions or phases, according to the temporary habitation of any such developing germ.

Man is infested by a peculiar form of tape-worm, the *Tœnia solium;* the dog by another, the *Tœnia serrata;* the cat by a third, the *Tœnia crassicollis;* and there are corresponding hydatids, or bladder-worms, such as the *Cœnurus cerebralis*, *Cysticercus fasciolaris*, *Cysticercus pisiformis* respectively found in the sheep, the rat, and rabbit; and every bladder-worm, on passing out of the body of the animal, enters that of another, to become a complete individual, with organs of propagation for the multiplication of its kind, for which every provision has been wisely made. Thus the hydatid of the brain of the sheep, on passing out through the bones of the skull, enters the body of the dog, and is developed into the *Tœnia serrata.*

We find impartial investigation, wherever sturdy prevails, invariably reveals the dependence of the malady on the dogs that accompany or guard the flock. A gentleman in Kincardineshire, on a farm not far from Lawrencekirk (I am alluding to Mr Alexander of Bent of Halkerton), had, in the year 1848, to clear his farm of neat stock, to stop the ravages of pleuro-pneumonia. He kept about 400 sheep for two years in this place, but, unlike the habitual sheep-farmer, kept no dogs, and he never saw a case of gid on his farm, except in an imported hogg.

Mr Walker of Portlethen keeps but few sheep, still a score or two are always on his farm. That number precludes the necessity of his having a dog, and he never saw a case of sturdy in his home-bred sheep; but in 1855 his turnips were eaten by sheep belonging to an extensive sheep-farmer, Mr Welsh of Ury. These sheep were accompanied by a dog, and three of the hoggs had sturdy.

Another very extraordinary case came to light in the course of my inquiries. I was kindly introduced by Sir John Stuart Forbes to Mr Farquharson of Gallonquine, who has always had about two score of Leicesters on his farm, but never saw a case of sturdy amongst his sheep, and does not remember ever seeing a dog anywhere near them. Although the number of sheep kept by Messrs Walker and Farquharson is small, still we should expect the usual per-centage of deaths by sturdy. Mr Alexander had a large flock, but circumstances led him to have it without a dog, and no death by sturdy occurred. I need not multiply observations of this kind. The more inquiries made, the more accurate will the conclusion arrived at by scientific men appear, and dogs and sheep must live together for certain parasites to extend their ravages with effect.

On all the sheep-farms I visited last autumn, sturdy was complained of, and on all such farms there were dogs. Such was the case at Cairnton, Mill of Kincardine, on Glendye, and in other localities.

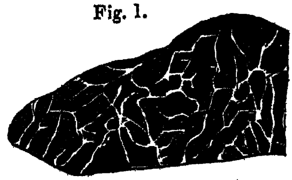
Mr Falconer of Balnakettle, a gentleman of great experience, and other farmers, assured me that there has been more giddiness in sheep within the last two or three years, than they have ever witnessed before, and the losses in consequence are sometimes greater than by that fatal malady "braxy." This clearly does not depend on a larger number of dogs being kept, but there are many conditions affecting the propagation of all parasites, and if destructive agencies were not as universal as the productive, much more effectually would vermin and parasites multiply and spread their baneful influence to the detriment of mankind. It is accidental circumstances that affect the development of diseases of animals. If every germ produced by a single tapeworm in a limited period of time were to take effect, it would be quite sufficient to exterminate the flocks of Great Britain; but, I repeat, the laws established to insure the multiplication of the species of any animal are counteracted by an infinity of uncontrolled, but perhaps not uncontrollable agencies. The latent vitality of the eggs of such parasites is extremely difficult to destroy; and to use the words of one of Küchenmeister's reviewers, "after months of exposure to warmth and moisture, the pulpy and putrid debris of segments of the *Tænia solium*, yield ova which show no sign of any approach of degeneration or decay. And the writer of this review has been struck by the remarkable way in which the size and structure of these ova sometimes allow them to elude all precautions that may be taken against their mechanical dispersion. In spite of every attempt to insure their destruction, by steeping the specimen-glasses he may have used in strong acids, and by afterwards bathing them in the flame of a spirit-lamp, he has once or twice found the characteristic ova appear most unaccountably in healthy and diseased tissues or secre-

tions of the human body, which he has subsequently examined with these glasses.

"The speedy death of the expelled joints is followed by their putrefaction; a process which is, of course, hastened by warmth and moisture. And the dissolution of the parent tissues ultimately sets free the eggs contained in their interior, to be carried by the winds or waves wherever accident may determine. How vast a number of them miscarry, is evident when we attempt to take the census of a single tapeworm. Or imagine the million of eggs such a parent foists upon society during the years it may inhabit a given animal. What becomes of these abortive germs, how long they retain any vitality, and what are the circumstances that may rob them of it,—are questions we cannot answer, save by the conjecture that their albuminous and fatty materials are either applied to the soil in a decomposed form, or are consumed as food by various of the minute invertebrata that throng the surface of the earth and the waters. But the more fortunate minority of these eggs, the destiny of which is to eat, instead of being eaten, after many and long wanderings of this passive nature, are at length engulfed by some unconscious animal in company with his food; and through its alimentary canal attain the locality of their second form of existence."

"During this passive migration the worm has retained its previous size ($\frac{1}{700}$th inch) and shape. But its thick wall now bursts and sets free the enclosed embryo, which is an ovoid body, of nearly equal size, armed with six hooklets at one extremity. Impelled by instinct to begin its active migration, the embryo pierces the first portion of its path by bringing together the anterior pair of hooks so as to form with them a kind of wedge-shaped stiletto, and now drags itself forward in the same direction by means of the two succeeding pairs of hooks, which it uses (to adopt the simile of our author) like a person who, in attempting to get out of a bow-window, thrusts himself forward by his elbows. In this way the minute embryo penetrates the body it inhabits, and only increases its efforts on reaching the place its instinct recognises as suitable for its abode, prior to the next series of changes it has to undergo. Streaks of reactive inflammation and exudation generally indicate the minute channel by which the embryo thus traverses the wall of the digestive canal in its course to the liver, or other organs (see fig. 1). The migration of a tænia is probably a passive process, but various facts suggest it to be also an active one—"a true locomotion, effected under the impulse of an instinct, and by means of certain special organs. The germs of parasites are evidently carried through the system in the stream of

Fig. 1.



circulating blood, and they do not always travel themselves through the interstices of tissues."

The annexed figure 2 shows at *b* how the small hydatid appears on the brain, and at fig. 3 is the embryonic condition with the hooklets that surround the least of the fully developed cœnurus. The shape of the separate hooks is indicated at *a*.

The cœnurus is represented at fig. 4 and 5. Fig. 4 represents the bladder to which several of the parasites *g g* in their rudimentary state are attached. Each parasite is from half a line to a line and a half in length, and less than half a line in breadth; it is white, cylindrical, folded circularly, prominent or rather hanging from the interior of the cyst, fig. 4 *g g*. The head is drawn out of the body as seen at fig. 5, which represents one of the objects at *h* in fig. 4, only much larger. Near the point of attachment *b* of the parasite to the common cyst is an opening *a*, out of which the head may pass and be free.

Fig. 2.

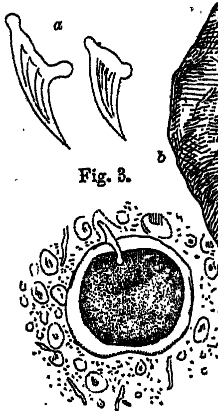


Fig. 3.

Fig. 4.

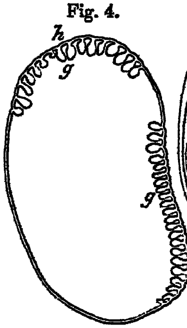
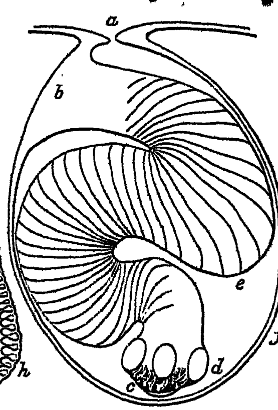


Fig. 5.



For long, sturdy was looked upon as dependent on simple accumulation of water in the brain—that, in fact, it was simple hydrocephalus, generally affecting one side of the head. Lecke had observed, in 1780, that the water-bladders in the brains of giddy sheep were animals, and Fabricius (Harvey's master) was the first to assert the same respecting the Cysticercus of the pig. It was supposed that they were the products of disease, even after it had been observed as probable that the intestinal worms were introduced from without; but the enclosed situations in which the hydatids were formed, and the absence of organs for procreation, caused them to be looked upon as animals of spontaneous or equivocal origin, the results of aggregation of matter, vital, yet in some way

similar to man and other living beings when first created. It had been observed that some animals put forth buds which separate from the main trunk, and develop into other beings of the same nature. Professor Bendz has observed this budding in a form of cysticercus. From the observations of Ehrenberg, in and since the year 1830, on the infusoria, the spontaneous generation was rendered very improbable. Eschricht thought he was one of the first (in 1838) to pronounce with certainty that all intestinal worms, without exception, descended from similarly formed animals. It was known as certain that the *Filaria medinensis*, which occurs in hot climates, entered the bodies of men from without. The cercariæ were known to undergo a series of developmental changes, and hence the origin of the intestinal worms was supposed to be complicated. Abildgaard, the founder of the Copenhagen Veterinary School, had observed that a tapeworm, the *Bothriocephalus latus*, which occurred in the abdominal cavity of the common stickleback, and in the intestinal canal of certain water-birds, never had eggs in the former, but always in the latter situation; and that from the first-mentioned creature it passed into the second, he ascertained by direct experiments with ducks which he fed on banstickles. The conclusion drawn from this was, that certain intestinal worms undergo their complete development by passing from one animal into the body of one of another species.

Goetze, in 1782, had perceived the great resemblance between the head of the hydatid of the liver of mice and rats (the *Cysticercus fasciolaris*), and of the tapeworm of the cat (*Tænia crassicollis*). It was the observation of this resemblance by Von Siebold, in 1844, which afterwards led to the researches respecting the specific identity of the hydatid and tape worms. Dr Allen Thomson says, "Dr Henry Nelson made the same observation without a knowledge of Von Siebold's views, and I repeated them with the same result; and Dr Nelson came to the same conclusion, now generally regarded as established, that the cat receives its *Tænia crassicollis* along with the flesh of the mouse or rat of which it has made prey."

The Cercariæ, opalescent infusorial animalcules, were first studied by Müller, then by Nitzsch; and lastly, Bojanus, in 1818, recognised them as parasitic in certain snails, enclosed in living bags or sporocysts, which were then called the "yellow worms of Bojanus." Von Baer, in 1826, showed the relation between the cercariæ and their sporocysts. M. Wagner and Von Siebold also contributed to advance our knowledge respecting them; and, lastly, Steenstrup discovered the changes the cercariæ underwent to become true flukes. Ehrenberg, in 1852, disputed Steenstrup's accepted metamorphoses, and only gives the resemblance of the tail-less cercariæ with a trematode worm.

From the near relationship between the sucking and tape worms, it was rendered probable that even these passed through different forms in their development, and that the hydatids were

to be looked upon as transitionary forms of the tænia. Van Beneden sought from 1849 to bring to bear his views that the species of Tetrarhyncus constituted the larvæ of the *Bothrio cephalus.* Von Siebold, on the contrary, thought the cysticerci were diseased tapeworms—diseased because growing in situations ill suited for their development.

Dr Küchenmeister of Zittau instituted certain ingenious experiments to settle this question. He made dogs and cats swallow hydatids, which developed into tapeworms in their intestines. From the hydatids of livers of mice arose the *Tænia crassicollis* in the intestines of the cat, and from the cysticercus of the hare or rabbit, the *Tænia serrata* in the intestine of the dog; so that the bladder of the hydatid is lost, the head of the worm attaches itself to the mucous membrane, and the rings constituting the body of the tapeworms, and including the organs of reproduction, are formed. These interesting experiments were repeated by several other zoologists (also cœnuri and echinococci), and confirmed.

Thus each head of the cœnurus from the brains of giddy sheep, if swallowed by a dog, becomes an independent tapeworm, which bears a striking resemblance with the long-known *Tænia serrata* of the dog. The *Echinococcus veterinorum*, which I have met with in several instances invading to an enormous extent the internal organs of horse and cattle, develops into a small tænia with only three serrations, the last one of which alone bears eggs. Küchenmeister reversed these experiments, and thus more strikingly proved the relationship between these different forms of the same animals. Thus the *Tænia crassicollis* or its eggs given to a family of white mice, which he had in his possession, produced the hydatids in their livers. Just the same happened by causing lambs to swallow the *Tænia serrata* of the dog; after fifteen days had elapsed, violent symptoms of sturdy supervened, and the growing hydatids were found in their brains. This experiment, first made on the 24th July 1853, has been since confirmed by other zoologists. Some of Küchenmeister's discoveries date back to the year 1851—it is found that not only are the germs conveyed to the brain, but to other parts of the body, and white or yellow bodies are discovered in the muscles; but in a muscle, a cœnurus cannot lie, and the germ is soon in process of destruction. What, however, as I have said before, appears very extraordinary, is that the rings of the tapeworm in a half-rotten condition, provided they have not dried, contain eggs, the development of which is more rapid than of those just freshly removed from the dog's intestine.

I have engaged my readers' attention for some considerable time on this subject, as it is one perfectly comprehensible, and of unsurpassable importance. Not only can we prevent disease in animals, but disease in man, by a full acquaintance with subjects such as the present, and the public mind is able to grasp such truths as con-

clusive, and magnificent as they are simple. To show how disease in man is intimately connected with disease in animals, I may mention that Von Siebold's experiments lead him to believe that the *Tænia serrata* of the dog, and the *Tænia solium* of man, are identical, "and not to be specifically distinguished; or that at most they are varieties of the same species, dependent only on the difference of their parasitic habitations." The hydatid of the brain of the sheep may, therefore, produce tapeworm in man, and accordingly butchers are found to be often affected with tapeworms.

The means of diminishing the amount of sturdy in sheep, and preventing analogous diseases in man, are, then, to a great extent, within our reach, and those proposed are as follow:—

1st, To diminish the number of dogs, and manage flocks in a different way.

2d, The evil should be generally made known; and, acting on that conviction, I have wished to lend my feeble voice in exposing the accidents to which animals and man are subjected, if dogs affected with tænia are allowed full freedom, and not watched and cured.

3d, Excrements of man or carnivora should not be used in fields where alimentary grasses are grown, and especially if the plants are in a forward state.

4th, Pure water should be supplied, that animals be not constrained from thirst to seek it in stagnant pools, ditches, &c.

5th, The flesh of animals affected with worms should not be eaten, and therefore proper inspectors of meats should attend slaughterhouses—inspectors that, being scientific men, and skilful veterinarians, would not be misled, as the ordinary meat-inspectors of Scotland and elsewhere. We should in this respect take example from our Continental friends, especially the French and Italians.

6th, Meat containing worms should not be given raw to dogs. If well cooked, the germs of the parasites are destroyed.

REPORT OF EXPERIMENTS IN THICK AND THIN SOWING OF OATS.

By Mr ALEXANDER BOWIE, Mains of Kelly, Forfarshire.*

THE present experiments have been undertaken solely with a view of testing the accuracy of those which were reported in the October number of the Society's Transactions for 1855, and the results, again obtained, are submitted with a confidence derived from extended experience, not only that they are according to truth in their general uniformity of feature and accuracy of detail, but that they establish in a strong and practical manner the propriety of the principle contended for, and which may shortly, and to the point, be stated in the question—Why may oats not be sown as thin as the other cereals?

It is not presumed for one moment that there are not districts in this country where superior farming intelligence has long since arrived at the truth here contended for, and where these tables and remarks may be stale and old-fashioned; still it cannot be denied, on the other hand, that there are a greater number of farmers who, unwilling to quit old practices, and heedless of the loss individually, and even nationally, continue annually to *smother* their land with seed, to the extent of six, seven, and even eight bushels of oats per Scotch acre! No doubt, a good old is better than a bad new method, and it is frankly admitted that not unfrequently "it is better to let well alone;" but the six, seven, and eight bushel farmers and crofters, great and small, are, with all respect and deference, asked not implicitly to subscribe to the arguments, or even to the repeated experiments of others, but practically to test for themselves the principle here advocated. The trial will only cost a few shillings; and if the results in pounds, shillings, and pence, have no influence, then may theory, argument, and experiment be abandoned. It is argued by many that their climate, poor-conditioned soil, &c., are unsuited to thin-sowing: it is simply asked, have they ever properly tried? It is not denied that the climate in which the reporter's experiments have been conducted is a little above the average of Scotland; but it is maintained that, where it is profitable to grow the cereals at all, the use of an indiscriminate quantity of seed is unprofitable, and that it is desirable to institute carefully conducted experiments for ascertaining what is the proper quantity which should be sown in this or that climate. In answer to the objection of poor-conditioned land, I would ask if the maximum of

* Mr Bowie's calculations, though relative to Scotch measurement, have been retained, to enable them to be compared with those published in 1855; but the attention of reporters is called to the rule requiring that "*weights and measurements must be indicated by the imperial standards.*"

seed generally sown will make the land rich, or give it strength to produce a full crop ?—or can it be expected that a poor soil will properly mature a dense thicket of oat plants? It is sometimes quoted from the highest authority, "He that soweth sparingly will also reap sparingly." But a question again recurs: What is "sowing sparingly?" and this is simply the question which is now respectfully recommended for the anxious consideration and solution of all farmers, in the hope that it will very shortly lead to a different practice from that which now too commonly prevails.

In the experiments carried out in 1854, and published in October 1855, the maximum and minimum in thick and thin sowing of oats were, respectively, 6 and 3 bushels per Scotch acre. In those conducted last year, and now submitted, the maximum is further reduced to 5, and the minimum to 2½ bushels; this last having been attempted with a view (to use a homely expression) of getting at the *back end* of thin-sowing. In 1854 the season proved dry, warm, and singularly fine for the proper maturation of all the cereals: 1856 just proved as singularly the reverse, being wet, cold, unsuitable for tillering, and eminently disastrous in its effects. In these two sets of experiments, the principle of thin-sowing of oats has therefore been subjected to the two extremes of our variable climate, and they are certainly not the less valuable on that account.

Attention is now directed to the different condition, quality of soils, &c., upon which the experiments of the two years were conducted, viz.—

In 1854, on Mains of Kelly, the soil was a brown loam, mostly incumbent on gravel, and in comparatively low condition.

In 1856, on West Scryne, it was brown, heavy, and somewhat stiff; and although not clay, incumbent on clay and a little sandy gravel—not so suitable for the use of the presser, but in the very highest condition.

In 1856, on Mains of Kelly, the soil was similar to that in 1854, but more suitable for the use of the presser, and in very good, although not the highest condition.

It will be observed that the experiments of 1856 were conducted on soils in a higher condition than those of 1854, yet the profits from thin-sowing were greatest where the land was in low condition. This is no doubt partly attributable to the higher price of oats at the earlier period, yet it supports the opinion I formerly advanced, that thick-sowing is less an evil on rich than on poor land.

Remarks on West Scryne Table.—As might have been inferred from the rich state of the soil, all the lots in this experiment started off with vigorous growth—Nos. 2 and 4, however, taking the lead; the latter from thick-sowing, and the former stimulated by the guano in close connection with the seed, in the pressed drills. Notwithstanding the cold and backward spring and summer, No. 2 soon got into a fearfully plethoric state of growth, and the guano

application was at once seen to be an error: the lot went down, with only half the ears out, nearly as flat as if a roller had passed over it. By the table it will be seen that this lot is fertile to excess in straw, which was so much damaged as to be only fit for use as inferior litter. The corn also is abundant, but very light; and it may be safely doubted whether, in the comparison between it and No. 1, the loss by applying guano is stated high enough. This trial is instructive against the indiscriminate use of guano. Although the presser was not expected to succeed so well on this field, the land being too heavy, yet in the thin-sown lots, results are prominently in favour of its use, as in lots 1 and 3. Three bushels pressed, against three unpressed, leave, after deducting cost of pressing, a profit of £1, 14s. 1d. per acre. Lot 8, pressed, and sown with the minimum quantity of seed, 2½ bushels, succeeded admirably; in money-value it is next, and comes nearly up to, lot 1, which carries the palm in this respect: it also beats in a most satisfactory manner lot 4, sown with double the quantity of seed—the difference in favour of 2½ being £2, 14s. 2d.; this lot speaks volumes in favour of thin-sowing. It was not deemed safe to have a 2½-bushel lot unpressed; but query, who knows? In the report of the experiment of 1855 it is stated that the presser "is profitable if accompanied with thin, and unprofitable if with thick sowing." If the reader will patiently examine and compare lots 4, 5, 6, and 7, in their respective yields both of straw and corn, he will find this opinion confirmed —the unpressed lots (if turned into money-value) beating the pressed by 6s. to 8s. each per acre on both the trials.

The presser is a most useful implement for easy dry soils. For saving seed and growing heavy crops, it is a powerful auxiliary to the farmer of such soils; perhaps it is equal, if not superior, to the drill in these respects. Many farmers are attracted to the presser, from the neat, uniformly consolidated seed-bed which it makes, and the complete and equally deep manner in which the seed is thereby covered in; and these are points which can scarcely be dispensed with in thin-sowing. The presser is accordingly procured at a cost of from £12 to £13: it is applied to the land, and then that bugbear "thin sowing" starts up, and causes them to crowd into the pressed drills 5, 6, or 7 bushels of seed-oats per acre. The result is of course a failure; the purchaser of the presser collapses into "old use and wont," and the hapless implement is forthwith consigned to the farmer's "tomb of all the Capulets"—viz., the old shed devoted to trash and useless implements. Such, doubtless, are the ends of many noble theories and inventions—good, if properly directed, and not bad, although they may be abused. Before concluding, the writer takes the liberty of alluding to the great crop of oats exhibited in this table, and begs to remark that, during a course of twenty-two years' experience, he has never reaped within 1½ quarters per acre of the amount.

Remarks on Mains of Kelly Table.—After what has been already stated, there is little scope for remark in regard to the remaining experiment. The thin-sown lots again, and for the third time, are triumphant in profitable results, 2½ bushels of seed beating 5 by a profit of £2, 2s. 4d. on the acre; and almost, if not altogether, carrying the palm from the 3 bushels per acre (lot 2.) Lot 3 comes well up in corn, but is deficient in the weight both of the corn and straw. Whether as regards equality of soil and size of lots, suitableness for the presser, and general satisfactory result, this experiment should yield to none of the others in carrying conviction to the doubtful.

In conclusion, What is the most plausible argument against sowing oats thin? It is replied, Because it has a tendency to make them ripen late. In a late season like the last one, this is granted; but in every instance in the writer's experience, the time lost in ripening was gained in winnowing in the stook: the thin-sown, being stronger in the straw, invariably required less time to make it fit for the stackyard. In the Mains of Kelly experiment all the lots were stacked the same day, although Nos. 3 and 4 were cut a week earlier than Nos. 1 and 2, and, by reference to the weight column, these proved heaviest per bushel, and consequently most valuable in the market. On the whole, it is believed that the opponents of thin-sowing of oats are chiefly, if not altogether, those who have never tried it, or have done so improperly. Some may read these imperfect remarks, and instantly conclude that they only develop the experimenter's weak point: in short, that he is simply riding a hobby-horse. He, nevertheless, entertains much confidence in his hobby, as a stout, somewhat slow, but safe nag, that will carry him and his thin-sowing theories safely into general practice.

TABLE.

EXPERIMENTS IN THICK AND THIN SOWING OF OATS ON THE FARM OF WEST SCRYNE, ARBROATH, IN 1856.

Lots all sown on 27th March.—All cut on 25th September.

No.	Treatment.	Rate sown per Scotch Acre.	Area.			Yield of Heavy Grain per Lot.			Yield of Light Grain per Lot.			Weight of Straw per Lot.			Gross Weight of Straw per Scotch Acre.			Gross yield of Grain per Scotch Acre. Imperial.	
Lots.		Imp. Bush.	Acres.	Roods.	Falls.	Bush.	Pecks.	Weight per Bush. Lb.	Bush.	Pecks.	Weight per Bush. Lb.	Cwt.	Qrs.	Lb.	Cwt.	Qrs.	Lb.	Qrs.	Bush.
1	Pressed, ...	3	0	1	3¾	24	1	41	1	3	38½	12	0	10	44	0	23	11	7
2	Pressed, and 2 cwt. guano per acre, ...	3	0	1	1¾	21	1	39	2	2	35½	15	0	20	58	0	18	11	3
3	Unpressed, ...	3	0	1	0	21	0	40¾	1	0	40	9	3	12	39	1	20	11	0
4	Pressed, ...	5	0	1	0¼	19	1	41½	2	0	40	9	3	0	38	3	0	10	4½
5	Unpressed, ...	5	0	0	36½	17	3	41	1	2	39½	9	3	16	43	1	13	10	4¼
6	Pressed, ...	4	0	0	36	16	3½	41¼	1	3½	39½	8	1	8	37	0	0	10	3¼
7	Unpressed, ...	4	0	0	34½	16	0	41	1	3½	39½	8	3	3	40	2	22	10	2¾
8	Pressed, ...	2½	0	0	34¼	17	1½	40½	2	0	38½	10	3	12	50	2	24	11	2½

Increase of Corn per acre in No. 1 over No. 2 with guano, ...	4 bushels at 26s. per quarter,	£0 13 0
Increased value of Straw in No. 1 over No. 2, the latter much damaged— . . .	say one-fourth depreciated,	0 1 6
Increased value of Corn in No. 1 over No. 2, ...	11⅜ quarters at 1s 6d. per quarter,	0 17 0
Cost of Guano application, ...	2 cwt. per acre at 13s.	1 6 0
Loss by the use of guano on rich land in a wet season, ...		£2 17 6
Increase of Corn per acre in No. 1 over No. 3, ...	7 bushels at 26s. per quarter,	£1 2 9
Increase of Straw per acre in No. 1 over No. 3, ...	38 stones imperial at 4d.,	0 12 8
		1 15 5
Deduct cost of pressing at the rate of 1s. 4d. per acre, ...		0 1 4
Total saved by the use of the Presser, and sowing 3 bushels per acre, . . .		£1 14 1
Increase of Corn per acre in No. 8 over No. 4, ...	6 bushels at 25s. per quarter,	£0 18 9
Increase of Straw per acre in No. 8 over No. 4, ...	95 stones imperial, slightly damaged, at 3½d.,	1 7 8
Saved in Seed per acre in No. 8 over No. 4, ...	2½ bushels at 25s. per quarter,	0 7 9
Total saved per acre by sowing 2½ instead of 5 bushels, ...		£2 14 2

EXPERIMENTS IN THICK AND THIN SOWING OF OATS ON THE FARM OF MAINS OF KELLY, ARBROATH, IN 1856.

Lots all sown on 25th March.—Nos. 3 and 4 cut on 12th, and Nos. 1 and 2 on the 18th September.

No.	Treatment.	Rate sown per Scotch Acre.	Area.			Yield of Heavy Grain per Lot.			Yield of Light Grain per Lot.			Weight of Straw per Lot.			Gross Weight of Straw per Scotch Acre.			Gross Yield of Grain per Scotch Acre. Imperial.	
Lots.		Imp. Bush.	Acres.	Roods.	Falls.	Bushels.	Pecks.	Weight per Bush. Lb.	Bushels.	Pecks.	Weight per Bush. Lb.	Cwt.	Qrs.	Lb.	Cwt.	Qrs.	Lb.	Qrs.	Bush.
1	Pressed,	2½	0	2	11	42	1	43	3	1	40	23	3	17	42	0	2	10	0
2	Pressed,	3	0	2	11½	42	2	43¼	3	0	39¼	24	1	8	42	2	3	9	7½
3	Pressed,	4	0	2	13¼	43	2	42¾	2	3	38¾	20	3	19	35	3	16	9	7¼
4	Pressed,	5	0	2	13¼	39	3	42¾	3	0	39¼	22	1	5	38	1	0	9	1¼

Increase of Corn per acre in No. 1 over No. 4, ...	6¾ bushels at 28s. per quarter,	£1 3 7
Increase of Straw per acre in No. 1 over No. 4, ...	30 stones imperial, at 4d.,	0 10 0
Saved in Seed per acre in No. 1 over No. 4, ...	2½ bushels at 28s. per quarter,	0 8 9
Total saved per acre by sowing 2½ instead of 5 bushels, ...		£2 2 4
Increase of Corn per acre in No. 2 over No. 4, ...	6¼ bushels at 28s. per quarter,	£1 1 10
Increase of Straw per acre in No. 2 over No. 4, ...	34 stones imperial, at 4d.,	0 11 4
Saved in Seed per acre in No. 2 over No. 4, ...	2 bushels at 28s. per quarter,	0 7 0
Total saved per acre by sowing 3 instead of 5 bushels, ...		£2 0 2

EXPERIMENTS WITH MANGOLD-WURZEL.

By James W. Hunter, Esq. of Thurston, Dunbar.

The discussion which took place at the Society's Monthly Meeting in March 1856, and the statements then made as to the precarious character of the turnip crop owing to finger-and-toe, and the suitableness of mangold as a substitute, induced me to institute the experiments, of which the results are contained in the appended Table. As each field of my turnip-break (220 acres) came to be sown, I reserved a few drills for long red and orange globe mangold, sown at the same time with, and manured and treated exactly like the turnips. I have contrasted the produce per imperial acre of mangold compared with that of turnips, and I think the result establishes that the former cannot, at all events, *take the place* of the latter; for, independently of other reasons, it would be impossible on large farms to get the land prepared for it by the time when it should be sown—the end of April or beginning of May.

The different lots were all ploughed about 11 inches deep, and sown in equal divisions with long red and orange globe. The dung was home-made, and was in each case, as nearly as possible, at the rate of 10 tons per acre. About half of the mangold on Lot 1 at Thurston ran to seed, and was pulled at once and given to cows, but it still remained the best crop; the long red ran much more to seed than the orange globe. There was but little seeding on any of the other fields, and I am led to infer that the height above the sea has a good deal to do with that, and with the growth of mangold generally. Between No. 1 Thurston and No. 4 Woodhall there was only a difference of four days in the sowing, and the manuring was the same; but the difference in level was 550 feet, and the crop on the latter was a failure. Even if that failure be attributed to other accidental causes, we find the smallest crop on the next highest altitude No. 3 of Woodhall, while the best was on the lowest, and the next on the second lowest lots—Nos. 1 and 3 of Thurston—200 and 290 feet above the level of the sea.

EXPERIMENTS WITH MANGOLD-WURZEL.

1. THURSTON.

Fields.	Altitude.	Date of Sowing.	Extent Sown.		Weight of Long Red.	Weight of Orange Globe.	Weight of Long Red per Imperial Acre.		Weight of Orange Globe per Imp. Acre.		Turnips—Weight per Imperial Acre.			Manure.
	feet.		poles.	yards.	cwt.	cwt.	tons.	cwt.	tons.	cwt.	Variety.	tons.	cwt.	
No. 1.	200	May 4	16	11	15	21	7	6	10	5	Swedes, . . .	14	11	Dunged on stubble, and 2 cwt. guano when drilled.
No. 2.	320	June 25	13	2	9	8	5	10	4	18	Purple top yellow,	14	8	Dung and 2 cwt. guano applied when drilled.
No. 3.	290	June 23	21	29	19	$20\frac{1}{2}$	5	14	7	9	White globe, .	23	10	Guano 4 cwt. in drills.
No. 4.	400	June 17	17	13	$12\frac{1}{2}$	12	5	14	5	10	Green-top white,	20	2	Dung and 2 cwt. guano in drills.

2. WOODHALL.

Fields.	Altitude.	Date of Sowing.	Extent Sown.		Weight of Long Red.	Weight of Orange Globe.	Weight of Long Red per Imperial Acre.		Weight of Orange Globe per Imp. Acre.		Turnips—Weight per Imperial Acre.			Manure.
No. 1.	450	June 20	12	0	$8\frac{1}{2}$	$9\frac{1}{4}$	5	13	6	3	Purple top yellow,	29	0	Dunged on stubble, and 2 cwt. guano in drills.
No. 2.	500	June 4	38	5	26	$27\frac{1}{2}$	5	0	5	15	Swedes, . . .	11	3	Dunged on stubble, and 2 cwt. guano in drills.
No. 3.	600	June 17	21	24	7	$8\frac{1}{2}$	2	11	3	2	White globe, .	17	14	4 cwt. guano in drills.
No. 4.	750	May 8	A dead failure—not half a cwt. of Mangold—so did not weigh turnips.											Dunged on stubble, and 2 cwt. guano in drills.

PREMIUMS AWARDED BY THE SOCIETY IN 1856.

I.—REPORTS.

1. The gold medal, or L.10, to James Cowan, Glasgow, for a Report on the Drainage of Sheep Farms.
2. The gold medal, or L.10, to Thomas Ferguson, Kinnochtry, Coupar-Angus, for a Report on Special Manures.
3. The gold medal, or L.10, to John Lennie, Lauder Barns, Lauder, for a Report on the best Construction of Plough.
4. The gold medal, or L.10, to John M'Laren, Rossie Priory, Inchture, for Reports on the Value of Cabbage for Feeding Purposes, and on Feeding Sheep under Cover.
5. The gold medal, or L.10, to William M'Leod, overseer, Fetternear, Keith Hall, for a Report on Deep Ploughing.
6. The gold medal, or L.10, to Robert Philip, forester, Aldbar, Brechin, for a Report on the General Management of Plantations.
7. The gold medal, or L.10, to James Porter, Monymusk, Aberdeen, for a Report on the Management of Home Farms.
8. The gold medal, or L.10, to James Westland, forester, Finhaven, Forfar, for a Report on River Embankments.
9. The medium gold medal, or L.5, to James Cowan, Glasgow, for a Report on the Diseases of Sheep.
10. The medium gold medal, or L.5, to James Cowan, Glasgow, for a Report on the Deterioration of Sheep Pasture.
11. The medium gold medal to Urquhart Fraser, for Reclaiming Waste Land.
12. L.5 to Alexander Bremner, crofter, Wood of Whyntie, Banff, for Reclaiming Waste Land.

II.—GENERAL SHOW OF STOCK AND IMPLEMENTS, held at INVERNESS on the 6th, 7th, and 8th of August 1856.

CLASS I.—CATTLE.

SHORT-HORN.

Judges—GEORGE A. GREY, Millfieldhill, Wooler; THOMAS SADLER, Norton Mains, Ratho.—*Attending Member*—A. HENDERSON, yr. of Stempster, Thurso.

Section

1. Best Bull calved before 1st Jan. 1854—L.20 to Arthur Harvey, Tillygreig, Aberdeen. The silver medal to Amos Cruickshank, Sittyton, Aberdeen, as the *Breeder* of the best Bull. Second—L.10 to A. Cruickshank, Sittyton, Aberdeen. Third—Certificate of merit to Charles Lyall, Kincraig, Brechin.
2. Best Bull calved after 1st Jan. 1854—L.15 to Thomas Willis, Manor House, Carperby, Bedale, Yorkshire. Second—L.8 to A. Cruickshank, Sittyton, Aberdeen. Third—Certificate to John Mackessack, Balnaferry, Forres.
3. Best Bull calved after 1st Jan. 1855—L.10 to William Tod, Elphinstone Tower, Tranent. Second—L.5 to Viscount Strathallan, Castle Strathallan, Auchterarder. Third—Certificate to C. Smith & Co., Hillhead, Nairn.
4. Best Cow of any age—L.10 to A. Cruickshank, Sittyton, Aberdeen.

Second—L.5 to Alex. M. Collie, Carsewell, Alves. Third—Certificate to John Mackessack, Balnaferry, Forres.

5. Best Heifer calved after 1st Jan. 1854—L.8 to A. Cruickshank, Sittyton, Aberdeen. Second—L.4 to the Duke of Richmond, Gordon Castle, Fochabers. Third—Certificate to The Viscount Strathallan, Castle Strathallan, Auchterarder.
6. Best Heifer calved after 1st Jan. 1855—L.6 to A. Cruickshank, Sittyton, Aberdeen. Second—L.3 to Jas. Geddes, Orbliston, Fochabers. Third —Certificate to Jas. Geddes, Orbliston.

HIGHLAND.

Judges—John Cruickshank, Cloves, Elgin; William M'Combie, Tillyfour, Aberdeen.—*Attending Member*—John Lorne Stewart of Coll.

7. Best Bull calved before 1st Jan. 1853—L.20 to Theodore Macrae, Struy, Strathglass, Beauly. Second—L.10 to the Right Hon. Duncan M'Neill of Colonsay, Lord Justice-General. Third—Certificate to Robert Maclean, Gordon Hall, Kingussie.
8. Best Bull calved after 1st Jan. 1853—L.15 to the Right Hon. Duncan M'Neill of Colonsay, Lord Justice-General. Second—L.8 to Alex. Stewart, Dalvey, Grantown. Third—No award.
9. Best Bull calved after 1st Jan. 1854—L.10 to John Gordon, Ballintomb, Grantown. Second and third—No Entry.
10. Best Cow of any age—L.10 to the Duke of Sutherland, Dunrobin Mains, Golspie. Second—L.5 to Neill Malcolm of Poltalloch, Lochgilphead. Third—Certificate to the Duke of Sutherland, Dunrobin Mains.
11. Best Heifer calved after 1st Jan. 1853—L.8 to the Right Hon. Duncan M'Neill of Colonsay, Lord Justice-General. Second—L.4 to Neill Malcolm of Poltalloch, Lochgilphead. Third—Certificate to John Gordon, Ballintomb, Grantown.
12. Best Heifer calved after 1st Jan. 1854—L.6 to George & J. G. Smith, Minmore, Ballindalloch. Second—L.3 to Alex. Stewart, Dalvey, Grantown. Third—Certificate to the Duke of Leeds.
13. Best Heifer calved after 1st Jan. 1855—L.4 to Robert Anderson, Meikle Kildrummie, Nairn. Secoud—L.2 to Alex. Stewart, Dalvey, Grantown. Third—Certificate to Hugh Fraser, Abersky, Inverness.

POLLED.

Judges—Alexander Bowie, Mains of Kelly, Arbroath; James Geddes, Orbliston, Fochabers; George Milne, Haddo, Methlic.—*Attending Member*—Sir John Stuart Forbes of Pitsligo, Bart.

14. Best Bull calved before 1st Jan. 1854—L.20 to William M'Combie, Tillyfour, Aberdeen. The silver medal to Alexander Bowie, Mains of Kelly, Arbroath, as the *Breeder* of the best Bull. Second—L.10 to G. Brown, Westerton, Fochabers. Third—Certificate to Lord Lovat, Beaufort Castle, Beauly.
15. Best Bull calved after 1st Jan. 1854—L.15 to the Earl of Southesk, Kinnaird Castle, Brechin. Second—L.8 to John Dunbar, Holme House, Ardersier. Third—No Entry.
16. Best Cow of any age—L.10 to William M'Combie, Tillyfour, Aberdeen. Second—L.5 to William M'Combie, Tillyfour. Third—Certificate to William M'Combie, Tillyfour.

17. Best Heifer calved after 1st Jan. 1854—L.8 to William M'Combie, Tillyfour, Aberdeen. Second—L.4 to the Earl of Southesk, Kinnaird Castle. Third—Certificate to John Dunbar, Holme House, Ardersier.
18. Best Heifer calved after 1st Jan. 1855—L.6 to George Brown, Westerton, Fochabers. Second—L.3 to William M'Combie, Tillyfour. Third—Certificate to William M'Combie, Tillyfour.

AYRSHIRE.

Judges—John Baird of Lochwood, Coatbridge; Patrick Graham Barns of Limekilns, East Kilbride; James Murdoch, Carntyne, Glasgow. *Attending Member*—Peter Drew, Carmyle, Glasgow.

19. Best Bull of any age—L.10 to John Stewart, Burnside, Strathaven. The silver medal to John Barclay, Jawston, Kilbirnie, Ayrshire, as the *Breeder* of the best Bull. Second—L.5 to Duncan Grant of Bught, Inverness. Third—Certificate to Donald Robertson, Dalneich, Inverness.
20. Best Cow of any age, in milk—L.8 to John Stewart, Burnside, Strathaven. Second—L.4 to John Stewart, Burnside, Strathaven. Third—Certificate to John Dunbar, Holme House, Ardersier.
21. Best Cow of any age, in calf—L.8 to John Stewart, Burnside, Strathaven. Second—L.4 to Duncan Grant of Bught, Inverness. Third—Certificate to Peter Brown, Linkwood, Elgin.
22. Best Heifer calved after 1st Jan. 1854—L.6 to John Stewart, Burnside, Strathaven. Second—L.3 to Eric Sutherland, Shempston, Elgin. Third—Certificate to Peter Brown, Linkwood, Elgin.

EXTRA CATTLE.

Judges.—The same as for Polled.

The following were commended:—Four Highland Oxen, belonging to Thomas Low, Ballimore, Grantown; two Highland Oxen, belonging to Robert Anderson, Meikle Kildrummie, Nairn; Two Cross Oxen, belonging to the Duke of Sutherland.

Class II.—Horses,

FOR AGRICULTURAL PURPOSES.

Judges—Captain Falconar, Foxhall, Kirkliston; John Gibson, Woolmet, Dalkeith; Alexander Lawson, Oldmills, Elgin; James Steedman, Boghall, Roslin; John Maclaren, Monzie, Blair-Atholl.—*Attending Members*—Colonel Houstoun and Major Horne.

Section

1. Best Stallion foaled before 1st Jan. 1853—L.25 to Robert Wilson, Durn, Portsoy. The silver medal to Robert Wilson, Durn, Portsoy, as the *Breeder* of the best Stallion. Second—L.12 to John L. Gow, Raith, Kirkcaldy. Third—Certificate to George Booth, V.S., Dundee.
2. Best Entire Colt foaled after 1st Jan. 1853—L.15 to David Riddell, Kilbowie, Duntochar, Dumbartonshire. Second—L.7 to John Collie, Ardgay, Forres. Third—Certificate to D. Jack, Middle Drums, Brechin.
3. Best Entire Colt foaled after 1st Jan. 1854—L.8 to Robert Wilson, Durn, Portsoy. Second—L.4 to Robert Wilson, Durn. Third—Certificate to John Fraser of Bunchrew, Inverness.
4. Best Entire Colt foaled after 1st Jan. 1855—L.6 to John Cruickshank,

Cloves, Elgin. Second—L.3 to John Mackintosh, Auchnacloich Cottage, Nairn. Third—Certificate to C. Smith & Co., Hillhead, Nairn.

5. Best Brood Mare foaled before 1st Jan. 1853—L.15 to George Williamson, Auldtown, Turriff. Second—L.7 to Archibald K. Leitch, Inchstelly, Alves. Third—Certificate to John Cruickshank, Cloves, Elgin.
6. Best Filly foaled after 1st Jan. 1853—L.8 to William Park, Boquhanran, Dalmuir, Dumbarton. Second—L.4 to A. Cruickshank, Sittyton, Aberdeen. Third—Certificate to J. Mackessack, Balnaferry, Forres.
7. Best Filly foaled after 1st Jan. 1854—L.6 to David Riddell, Kilbowie, Duntocher, Dumbartonshire. Second—L.3 to J. Cruickshank, Cloves, Elgin. Third—Certificate to A. Cruickshank, Sittyton, Aberdeen.
8. Best Filly foaled after 1st Jan. 1855—L.4 to James D. Grigor, Wester Alves, Elgin. Second—L.2 to Arch. K. Leitch, Inchstelly, Alves. Third—Certificate to Arch. K. Leitch, Inchstelly, Alves.

PONIES.

9. Best Stallion not exceeding 14 hands—L.10 to D. Macleod, Kingsburgh, Portree. Second—L.5 to D. Macleod, Kingsburgh. Third—No Award.
10. Best Mare not exceeding 14 hands—L.8 to A. Oliver, Antfield, Inverness. Second—L.4 to G. Cruickshank, Barnhill, Elgin. Third—Certificate to Peter Brown, Linkwood, Elgin.

EXTRA HORSES.

The following were commended by the Judges :—A Half-bred Colt belonging to James Cameron, Balnakyle, Munlochy ; two Roadsters, belonging to George France, Wester Lovat, Bogroy ; a Colt and Filly, belonging to George Johnson, Springfield, Forres; a Half-bred Cleveland Colt, belonging to Eneas Mackintosh of Daviot, Inverness ; a Pony Gelding, belonging to Thomas Low, Ballimore, Grantown ; a Pony Stallion, belonging to Dudley Coutts Marjoribanks of Guisachan, Cannich, Beauly ; a Pony Gelding, belonging to M. S. Boulderson, Ord House, Beauly ; two Pony Geldings, belonging to Lord Lovat, Beaufort Castle, Beauly.

Class III.—Sheep.

LEICESTER.

Judges—Arthur Harvey, Tillygreig, Aberdeen ; Geo. Hope, Fenton Barns, Drem.—*Attending Member*—Wm. Forbes Mackenzie of Portmore.

Section

1. Best Tup, not more than four shear—L.10 to Thomas Simson, Blainslie, Lauder. Second—L.5 to James Black, Knock, Keith. Third—Certificate to Thomas Simson, Blainslie, Lauder.
2. Best Dinmont or Shearling Tup—L.10 to Thomas Simson, Blainslie, Lauder. Second—L.5 to Wm. Tod, Elphinstone Tower, Tranent. Third—Certificate to John Collie, Ardgay, Forres.
3. Best Pen of five Ewes, not more than four shear—L.6 to John Collie, Ardgay, Forres. Second—L.3 to Thomas Mason, Pallinsburn, Northumberland. Third—Certificate to J. Mackintosh, Auchnacloich Cottage, Nairn.
4. Best Pen of five Shearling Ewes or Gimmers—L.6 to J. Collie, Ardgay, Forres. Second—L.3 to Thomas Mason, Pallinsburn, Northumberland. Third—Certificate to T. Mason, Pallinsburn, Northumberland.

CHEVIOT.

Judges—ADAM BLACKLOCK, Minnygaff, Moffat; JOHN COLLIE, Ardgay, Forres; JOHN HALL, Sciberscross, Golspie.—*Attending Member*—F. N. MENZIES, Tirinie, Aberfeldy.

5. Best Tup, not more than four shear—L.10 to James Brydon, Moodlaw, Langholm. Second—L.5 to James Brydon, Moodlaw, Langholm. Third—Certificate to James Brydon, Kinnelhead, Moffat.
6. Best Dinmont or Shearling Tup—L.10 to Donald Horne of Langwell, Caithness. Second—L.5 to James Brydon, Kinnelhead, Moffat. Third—Certificate to James Brydon, Moodlaw, Langholm.
7. Best pen of five Ewes, not more than four shear—L.6 to W. Gunn, Glendhu, Lairg. Second—L.3 to Donald Horne of Langwell, Caithness. Third—Certificate to Sutherland Murray, Kirkton, Golspie.
8. Best Pen of five Shearling Ewes or Gimmers—L.6 to James Brydon, Moodlaw, Langholm. Second—L.3 to John Carruthers, Kirkhill, Moffat. Third—Certificate to William Gunn, Glendhu, Lairg.

BLACKFACED.

Judges—JOHN MACLAREN, Monzie, Blair-Atholl; JAMES MACPHERSON, Biallid, Kingussie; ALEX. STEWART, Dalvey, Grantown.—*Attending Member*—W. A. CAMPBELL of Ormsary.

9. Best Tup, not more than four shear—L.10 to Alex. Macdonald, Strathmashie, Laggan, Kingussie. Second — L.5 to Adam Blacklock, Minnygap, Moffat. Third—Certificate to Charles Summers, Whitefield, Haydon Bridge, Northumberland.
10. Best Dinmont or Shearling Tup—L.10 to Adam Blacklock, Minnygaff, Moffat. Second—L.5 to Adam Blacklock, Minnygaff. Third—Certificate to Alexander Macdonald, Strathmashie, Laggan.
11. Best Pen of five Ewes, not more than four shear—L.6 to Alexander Macdonald, Strathmashie, Laggan, Kingussie. Second—L.3 to Hugh Andrew Johnston Munro, of Novar, Evanton. Third—No Award.
12. Best Pen of five Shearling Ewes or Gimmers—L.6 to James Brydon, Kinnelhead, Moffat. Second—L.3 to Charles Alexander, Inversanda, Ardgour, Bonawe. Third—Certificate to Alex. Macdonald, Strathmashie, Kingussie.

SOUTHDOWN.

Judges—RT. JOPP, Seggat, Auchterless; GEO. WILLIAMSON, Auldtown of Carnousie, Turriff.—*Attending Member*—RT. SIMPSON of Cobairdy.

13. Best Tup, not more than four shear—L.10 to James Aitchison of Alderston, Haddington. Second—L.5 to the Duke of Richmond, Gordon Castle, Fochabers. Third—Certificate to the Duke of Richmond, Gordon Castle.
14. Best Dinmont or Shearling Tup—L.10 to John Hutchison, Monyruy, Peterhead. Second—L.5 to John Hutchison, Monyruy. Third—Certificate to R. Scot Skirving, Camptown, Haddington.
15. Best Pen of five Ewes, not more than four shear—L.6 to Robert Scot Skirving, Camptown, Haddington. Second—L.3 to the Duke of Richmond, Gordon Castle. Third—Certificate to Robert Scot Skirving, Camptown, Haddington.
16. Best Pen of five Shearling Ewes or Gimmers—L.6 to John Hutchison, Monyruy, Peterhead. Second—L.3 to the Duke of Richmond, Gordon

Castle. Third—Certificate to Robert Scot Skirving, Camptown, Haddington.

LONG-WOOLLED OTHER THAN LEICESTER.

Judges—ARTHUR HARVEY, Tillygreig, Aberdeen; GEORGE HOPE, Fenton Barns, Drem.—*Attending Member*—WILLIAM FORBES MACKENZIE of Portmore.

17. Best Tup, not more than four shear—L.10 to the Duchess of Gordon, Huntly Lodge, Huntly. Second—L.5 to Robert Scot Skirving, Camptown, Haddington. Third—Certificate to Lord Kinnaird, Rossie Priory, Inchture.
18. Best Pen of five Ewes, not more than four shear—L.6 to Lord Kinnaird, Rossie Priory, Inchture. Second and third—No Entry.

EXTRA SHEEP.

Judges—ARTHUR HARVEY, Tillygreig, Aberdeen; ROBERT JOPP, Seggat, Auchterless; GEORGE WILLIAMSON, Auldtown of Carnousie, Turriff.

Five Leicester Lambs, belonging to James Kemp, Kemptown, Forres, highly commended. A Southdown Tup, belonging to William Tod, Elphinstone Tower, Tranent, commended. A Cross-bred Southdown Tup, belonging to T. P. Bonell Biscoe of Newton, Inverness, commended.

CLASS IV.—SWINE.

Judges—SIR JAMES D. H. ELPHINSTONE of Logie-Elphinstone, Bart.; JOHN MACLAREN, Rossie Priory, Inchture; JAMES MELVIN, Bonnington, Ratho.—*Attending Member*—WILLIAM GUNN, Glendhu, Golspie.

Section

1. Best Boar, large breed—L.6 to Robert Anderson, Meikle Kildrummie, Nairn. Second—L.3 to James Skinner, Woodside, Aberdeen. Third—Certificate to John Macintyre, Culcharry, Cawdor, Nairn.
2. Best Boar, small breed—L.6 to George Brown, Westerton, Fochabers. Second—L.3 to John Mackessack, Balnaferry, Forres. Third—Certificate to Sir Charles Ross of Balnagown, Bart., Parkhill.
3. Best Sow, large breed—L.4 to James Skinner, Woodside, Aberdeen. Second—L.2 to James Skinner, Woodside. Third—No Entry.
4. Best Sow, small breed—L.4 to John Alderson, Thornby, Wigton, Cumberland. Second—L.2 to John Alderson, Thornby, Wigton, Cumberland. Third—Certificate to John Gibson, Woolmet, Dalkeith.
5. Best Pen of Three Pigs, not exceeding eight months old—L.4 to John Alderson, Thornby, Wigton. Second—L.2 to John Cruickshank, Cloves, Elgin. Third—Certificate to J. Skinner, Woodside, Aberdeen.

CLASS V.—POULTRY.

Judges—Sir JAMES D. H. ELPHINSTONE; JOHN MACLAREN, Rossie Priory, Inchture; JAMES MELVIN, Bonnington, Ratho.—*Attending Member*—WILLIAM GUNN, Glendhu, Golspie.

Section

1. Best coloured Dorking Cock and Two Hens—the silver medal to John Gibson, Woolmet, Dalkeith. Second—Certificate to A. Davidson, Nairn.
2. Best white Dorking Cock and Two Hens. *No award.*
3. Best coloured Cochin-China Cock and Two Hens—the silver medal to

the Lady Anne Mackenzie of Scatwell, Rosehaugh, Munlochy. Second—Certificate to Hugh Fraser, Balloch of Culloden, Inverness.

4. Best white Cochin-China Cock and Two Hens. *No entry.*
5. Best Bramahpootra Cock and Two Hens—the silver medal to Dudley Coutts Marjoribanks of Guisachan, Beauly.
6. Best Malay Cock and Two Hens. *No entry.*
7. Best Spanish Cock and Two Hens—the silver medal to Dudley Coutts Marjoribanks of Guisachan. Second—Certificate to H. Fraser, Balloch of Culloden, Inverness.
8. Best Golden Hamburgh Cock and Two Hens. *No award.*
9. Best Silver Hamburgh Cock and Two Hens—the silver medal to Alex. M. Collie, Carsewell, Alves. Second—Certificate to Hugh Fraser, Balloch of Culloden, Inverness.
10. Best Poland Cock and Two Hens—the silver medal to Lieut.-Colonel Alex. Houstoun, Castlehill, Inverness.
11. Best Game Cock and Two Hens. *No entry.*
12. Best Cock and Two Hens of any other distinct breed. *No entry.*
13. Best Bantam Cock and Two Hens—the silver medal to T. P. Bonell Biscoe of Newton, Inverness. Second—Certificate to W. A. Stables, Cawdor Castle, Nairn.
14. Best Three Capons. *No entry.*
15. Best white Aylesbury Drake and Two Ducks—the silver medal to Lord Lovat, Beaufort Castle. Second—Certificate to Hugh Fraser, Balloch of Culloden, Inverness.
16. Best Rouen Drake and Two Ducks—the silver medal to Lord Lovat, Beaufort Castle, Beauly.
17. Best Drake and Two Ducks of any other breed. *No award.*
18. Best Black Norfolk Turkey Cock and Two Hens—the silver medal to John Cruickshank, Cloves, Elgin.
19. Best Turkey Cock and Two Hens of any other breed. *No entry.*
20. Best Gander and Two Geese—the silver medal to Lord Lovat, Beaufort Castle, Beauly. Second—Certificate to John Cruickshank, Cloves, Elgin.

CLASS VI.—IMPLEMENTS AND MACHINES.

Judges—JOHN GIBSON, Woolmet, Dalkeith; JOHN M'LAREN, Rossie Priory, Inchture; JOHN MILLER of Leithen, Polmont; JAMES STEEDMAN, Boghall, Roslin; JAMES STIRLING, C. E., Edinburgh.—*Attending Member*—Captain FALCONAR, Foxhall, Kirkliston.

Section

1. Best Two-horse Plough for general purposes—L.3 to George Sellar & Son, Huntly. In this section the Judges commended ploughs belonging to Robert Law, Shettleston, and George Sellar & Son.
2. Best Trench or Deep-Furrow Plough—L.3 to George Sellar & Son.
3. Best Subsoil Plough for Two Horses—L.4 to James Kirkwood, Tranent Foundry, East-Lothian. A Subsoil Plough, belonging to John Gray & Co., Uddingston, Glasgow, commended.
4. Best Subsoil Plough for Moor and Stony Land, for Three or Four Horses—L.4 to John Gray & Co., Uddingston, Glasgow.
5. Best Double Mould-Board Plough for forming Drills—L.3 to George Sellar & Son, Huntly.
6. Best Ribbing or Drill-Paring Plough. *No entry.*

7. Best Improvement on, or Substitute for, the Common Plough, in lifting Potatoes—L.3 to Robert Law, Shettleston, Glasgow.
8. Best Two-Horse Grubber or Cultivator—L.4 to John Gray & Co., Uddingston, Glasgow.
9. Best Drill-Grubber for Green Crops—L.2 to James Kirkwood, Tranent.
10. Best Norwegian Harrow—L.4 to James Kirkwood, Tranent.
11. Best Consolidating Land-Roller. *No award.*
12. Best Land-Presser, for preparing Seed-bed for Grain—L.5 to Young, Peddie, & Co., Edinburgh and Glasgow.
13. Best Ribbing Machine—L.2 to James Kirkwood, Tranent.
14. Best Pulverising Land-Roller—L.5 to James Suttie, Inchture.
15. Best Harrows for Heavy Land—L.3 to John Gray & Co., Uddingston.
16. Best Harrows for Light Land—L.3 to Robert Law, Shettleston, Glasgow.
17. Best Common Swing-Trees or Draught-Bars—L.1 to Alex. & George H. Slight, Edinburgh.
18. Best Equalising Swing-Trees or Draught-Bars—L.1 to Robert Law, Shettleston, Glasgow.
19. Best Broadcast Sowing-Machine for Grain and Grass-Seeds—L.6 to Robert Law, Shettleston, Glasgow.
20. Best Drill Sowing-Machine for Grain—L.6 to James Smith, Lawhill, Auchterarder.
21. Best Horse-Hoe for Drilled Grain Crops. *No award.*
22. Best Sowing-Machine for Turnips—L.4 to John Gray & Co., Uddingston.
23. Best Sowing-Machine for Turnips with Manure. *No award.*
24. Best Dibbling or Drop Sowing-Machine for Turnips with Manure. *No entry.*
25. Best Three-Row Sowing-Machine for Beans. *No entry.*
26. Best One-Row Bean-Sowing Machine. *No award.*
27. Best Dry Manure Distributing Machine. *No entry.*
28. Best Liquid-Manure Distributing Machine. *No entry.*
29. Best Liquid Manure Pump—L.2 to Smith Brothers & Co., Kinning Street, Glasgow.
30. Best Straw-Cutter for hand labour—L.2 to Richmond and Chandler, Salford, Manchester.
31. Best Straw-Cutter for power—L.3 to Richmond and Chandler, Salford.
32. Best Turnip-Cutter for Sheep—L.2 to Richmond and Chandler, Salford.
33. Best Turnip-Cutter for Cattle. *No award.*
34. Best Turnip-Cutter for Sheep, adapted for attachment to a Cart—L.3 to Caldow and Mackennel, Palmerston Ironworks, Dumfries.
35. Best Linseed-Bruiser for hand labour—L.2 to Richmond and Chandler.
36. Best Grain and Linseed-bruiser for power—L.4 to Richmond and Chandler, Salford, Manchester.
37. Best Root-Washer—L.2 to Richmond and Chandler, Salford, Manchester.
38. Best Steaming Apparatus for preparing Food—L.5 to Smith Brothers & Co., Kinning Street, Glasgow.
39. Best set of Troughs for Feeding Byres. *No award.*
40. Best Sheep Fodder Rack—L.2 to James Kirkwood, Tranent.
41. Best One-Horse Farm-Cart—L.4 to Robert Law, Shettleston, Glasgow. Carts belonging to Peter Davidson, Broom, Auchterarder, and Robert Fraser, Forres, were commended.
42. Best light Spring-Cart. *No entry.*
43. Best Harvest Cart. *No entry.*

44. Best Apparatus for conveying Implements on the Farm. *No entry.*
45. Best Stone or Iron Stack Pillars, with Framework—L.2 to Young, Peddie, & Co., Edinburgh and Glasgow. Stack Pillars, belonging to Hernulewicz, Main, & Co., Glasgow, were commended.
46. Best Horse Stubble or Hay Rake—L.2 to James Kirkwood, Tranent.
47. Best Scythe for general purposes—L.1 to James Smith, Lawhill Auchterarder. A Scythe belonging to William Hanton, Drunkendub, Chance Inn, was commended.
48. Best Improvement on any part of the Thrashing Machine. *No award.*
49. Best Thrashing Machine, adapted for two or more horses—L.6 to John Gray & Co., Uddingston, Glasgow.
50. Best Thrashing Machine, with English high-speed open Drum, combined with Shakers, Fanners, &c., on the Scotch principle. *No entry.*
51. Best Hummeler, for attachment to a Thrashing Machine. *No award.*
52. Best Dressing Fanners—L.4 to George Clark, Forres.
53. Best Weighing Machine for the Barn, indicating measure and weight of Grain at one operation—L.4 to Smith Brothers & Co., Glasgow.
54. Best Weighing Machine, indicating from 1 ℔. to 2 tons—L.4 to Smith Brothers & Co., Glasgow.
55. Best Churn worked by hand—L.2 to J. Gray & Co., Uddingston, Glasgow.
56. Best Churn worked by Power—L.3 to Philip Hunter, Edinburgh.
57. Best Cheese Press—L.2 to T. J. L. Brooke, Mere, Knutsford, Cheshire.
58. Best Curd-Cutter—L.1 to James Smith, Lawhill, Auchterarder.
59. Best general set of Dairy Utensils—L.1 to Philip Hunter, Edinburgh.
60. Best Field Gate, constructed entirely of Iron—L.1 to Hernulewicz, Main, & Co., Glasgow, Belfast, & London. A Field Gate belonging to Hernulewicz, Main, & Co., Glasgow, commended.
61. Best Field Gate, not constructed entirely of Iron. *No award.*
62. Best six Iron Hurdles for a Fence to retain Cattle—L.2 to Hernulewicz, Main, & Co.
63. Best set of Traverse Divisions, Rack, and Manger for Farm Stables—L.2 to Hernulewicz, Main, & Co.
64. Best set of Farm Harness—L.1 to Francis Campbell, saddler, Inverness.
65. Best set of Tiles and Pipes for Field Drainage. *No entry.*
66. Best set of Glazed Socketed Pipes for Sewerage. *No entry.*
67. Best set of Tools for Cutting Field Drains—L.1 to William Cadell, Sons, & Co., Cramond.
68. Best set of Tools for Cutting Open Drains in Hill Pastures—L.1 to William Cadell, Sons, & Co., Cramond.
69. Best general set of Hand Implements for the Farm. *No award.*
70. Best Dynamometer for general Purposes—L.5 to Alexander and George H. Slight, Edinburgh.

The following Articles were commended :—

EXTRA IMPLEMENTS.

A Horse Hoe, or Drill Harrow, belonging to P. Macgregor and Sons, Keith ; a Yester Plough for two horses, a Tweeddale Plough for four horses, a Tweeddale Trench Plough, for four horses, and a Soam Chain and Pulley for four horse yoke, belonging to Alex. and G. H. Slight, Edinburgh ; and a Steam-Engine, belonging to Smith Brothers & Co., Glasgow.

MISCELLANEOUS ARTICLES.

Sheep Dipping Apparatus on Wheels, and Sheep Dipping Apparatus, with Iron-barred Drainer, belonging to Thomas Bigg, Leicester House, Great Dover Street, Borough, London.

GENERAL COLLECTION.

Specimen of Royal Albert Garden Chairs; Ornamental Fences for Gardens, and Specimens of Iron and Wire Camp Stools, Royal Balmoral Garden Chair, Two Royal Victoria Garden Chairs, Six Poultry Feeders, Long Pig Trough, and Sack Holder and Barrow, belonging to Hernulewicz, Main, and Co., Glasgow, Belfast, and London; Patent Turnip Cutter, Oil-cake Crusher, and Improved Sack Holder, belonging to Richmond and Chandler, Salford, Manchester; Collection of Glazed Troughs for Cattle, Horse Mangers, &c., belonging to John Robson, 26 Commerce Street, Glasgow; Collection of Flower Vases, Pedestals, Chimney Cans, &c., belonging to John Wauchope of Edmonstone, Dalkeith; 2 Wrought-Iron Lodge Entrance Gates, Carriage Road Gate, Iron and Wire Arches for Gardens, Two-Horse Swing Plough, Iron Plough Guide, Drill Harrow, Iron Tar Barrow Apparatus, Iron Cheese Press, Wire Flakes for Enclosing Sheep, Wire Netting for Enclosing Sheep, Wire Netting for Enclosing Poultry, belonging to Young, Peddie, and Co., Edinburgh and Glasgow.

III.—DISTRICT COMPETITIONS.

CATTLE.

The Island of Lews.

BULLS, Class I.*	1. Dr Charles M'Rae, Barras, Stornoway, .	L.4	0	0†
	2. Alexander M'Leod, Valtos, Stornoway, .	2	0	0‡
HEIFERS.	1. David Houston, Melbost, Stornoway, .	5	0	0
	2. John Hunter, Arnish, Stornoway, .	3	0	0

The Stewartry of Kirkcudbright.

BULLS.	Alexander Kerr of Scroggiehill, .	Silver Medal.		
BULLS, Class I.	1. J. & W. Burnie, Stonehouse, Dumfries,	L.8	0	0
	2. William Clark, Cowar, Dalbeattie, .	4	0	0
BULLS, Class II.†	J. Cunningham, Whitecairn, K. Durham,	5	0	0
HEIFERS.	1. James Shennan, Balig, Kirkcudbright, .	5	0	0
	2. John Cunningham, Whitecairn, .	3	0	0

The Middle Ward of Lanarkshire, &c.

BULLS.	John Hamilton of Burnbrae, Avondale,	Silver Medal.		
BULLS, Class I.	1. John Stewart, Burnside, Strathaven,	L.8	0	0
	2. Adam Letham, Crofthead, Stonehouse,	4	0	0
BULLS, Class II.	John Torrance, Crookedstone, Hamilton,	5	0	0
HEIFERS.	1. John Stewart, Strathaven, . .	5	0	0
	2. Andrew Logan, Claddens, East Kilbride,	3	0	0

The District of Strathspey.

BULLS.	John Gordon, Ballintomb, Grantown,	Silver Medal.

* Class I., Bulls calved before 1st January 1854.
† Class II., Bulls calved after 1st January 1854.
‡ Half Premiums awarded, the number of lots being under six.

DRAUGHT HORSES.

The District of Strathendrick.

STALLIONS.	John Paterson, Waterlee, Houston, . .	L.25 0 0
MARES.	John Buchanan, Coldrach, Drymen, . .	10 0 0
FILLIES.	Do. do. . .	5 0 0

The County of Forfar.

STALLIONS.	George Booth, V.S., Dundee, . .	L.25 0 0
MARES.	Alexander Kydd, Balmirmar, Arbroath, .	10 0 0
FILLIES.	Alexander Pattullo, Strathmartin, . .	5 0 0

The District of Lauderdale.

STALLIONS.	Robert Craig, Burnside Street, Glasgow, . .	L.25 0 0
MARES.	James Laurie, Mitchelson, Stow, . .	10 0 0
FILLIES.	Wm. Broomfield, Spotsmains, Kelso, . .	5 0 0

The District of Glasgow.

TWO-YEAR-OLD-COLTS.	Hugh Vallance, Greathill, Avondale,	L.6 0 0
ONE-YEAR-OLD-COLTS.	Thomas Young, Tailend, Dunlop, .	4 0 0

The District of Mid-Calder.

TWO-YEAR-OLD-COLTS.	R. Jack, West Craigs, Corstorphine,	L.6 0 0
ONE-YEAR-OLD-COLTS.	George Davidson, Dean Park, Balerno,	4 0 0

LEICESTER SHEEP.

The Counties of Edinburgh and Haddington.

TUPS.	Thomas Simson, Blainslie, Lauder, .	L.5 0 0

The County of Ayr.

TUPS.	John Rankine of Beoch, Maybole, . .	L.5 0 0
EWES.	William Caldwell, Boydstone, Ardrossan,	2 10 0*

CHEVIOT SHEEP.

The District of Tobermory, &c.

TUPS.	J. Sellar of Ardtornish, Morven, Oban,	Silver Medal.
TUPS.	Charles Johnstone, Mongarry, Strontian,	L.5 0 0
SHEARLING TUPS.	Do. do.	5 0 0
EWES.	W. E. Oliver, Mungostell, Morven, Oban,	5 0 0
SHEARLING EWES.	Charles Alexander, Inversanda, Strontian,	4 0 0

BLACKFACED SHEEP.

The District of Cowal.

TUPS.	John Whyte, Ballochyle, Kilmun, .	L.5 0 0
SHEARLING TUPS.	Duncan Turner, Corrachane, Kilmun, .	5 0 0
EWES.	John Whyte, Ballochyle, Kilmun, .	4 0 0
SHEARLING EWES.	Thomas Clark, Craigindive, Dunoon, .	4 0 0

The Districts of Currie, Penicuik, and Biggar.

TUPS.	John Watson, Nisbet, Biggar, . .	L.5 0 0
SHEARLING TUPS.	Do. do. . .	5 0 0
EWES.	Do. do. . .	4 0 0
SHEARLING EWES.	David Wilson, Halls, Penicuik, . .	4 0 0

The Districts of Breadalbane and Weem.

TUPS.	John Campbell of Garrows, Amulree,	Silver Medal.
TUPS.	Do. do. .	L.5 0 0

* Half Premiums awarded, the number of lots being under six.

SHEARLING TUPS.	John Robertson, Glenlyon House, Fortingal,	2 10 0*
EWES.	Campbell and M'Diarmid, Claggan, Kenmore,	2 0 0*
SHEARLING EWES.	John Robertson, Glenlyon House, Fortingal,	4 0 0

SWINE.

The Districts of Lower Annandale and Nithsdale.

BOARS.	1. Miss Bell, Woodhouselees, Canonbie,	L.4 0 0
	2. John Birrell, Guards, Gretna,	2 0 0
SOWS.	1. John Mackenzie, Barnhill, Lochmaben,	1 10 0*
	2. Thomas Marshall, Howes, Annan,	0 10 0*

The District of Formartine.

BOARS.	1. James Skinner, Woodside, Aberdeen,	L.2 0 0*
	2. John Argo, Mill of Cavel, Summerhill,	1 0 0*
SOWS.	1. George Shepherd, Shethin, Tarves,	3 0 0
	2. James Hay, Nethermill, Tarves,	1 0 0

DAIRY PRODUCE.

The District of Lorn.

CURED BUTTER.	S. J. Popham of Ardchattan,	Silver Medal.
Do.	Mrs M'Innes, Achnaba,	L.3 0 0
Do.	Mrs Beverley, Lerags,	2 0 0
SWEET-MILK CHEESE.	Mrs Cheyne of Lismore,	Silver Medal.
Do.	Mrs Beverley, Lerags,	L.3 0 0
Do.	Mrs Macpherson, Clachadhu,	2 0 0

The District of Ardrossan.

CURED BUTTER.	John Crawford of Millstoneford,	Silver Medal.
Do.	James Kirkhope, Fergushill,	L.3 0 0
Do.	Andrew Kirkwood, Dykes Mains,	2 0 0
SWEET-MILK CHEESE.	David Cuninghame, Chapelton,	3 0 0
Do.	Samuel Taylor, Bushie, Ardrossan,	2 0 0

District of Kintyre.

CURED BUTTER.	John Mitchell, Ballemenach,	L.3 0 0
Do.	John Arthur, Skeroblingorry,	2 0 0
SWEET-MILK CHEESE.	Alexander Snodgrass, East Chescan,	3 0 0
Do.	Robert Aitken, Skeroblinraw,	2 0 0

SEEDS.

The Silver Medal has been awarded to the following parties:—

The District of Kintyre.

Alexander Snodgrass, East Chescan, for Sandy Oats.
James Letham, Tradigle, for Bere.
Mathew Andrew, Andrewstone, for Perennial Rye-Grass Seed.

The District of Buchan.

William Scott, Wester Rora, for early Berlie Oats.
George Anderson, Hallmoss, for Perennial Rye-Grass Seed.

The County of Banff and Turriff District.

Alexander Murray, Old Manse of Boyndie, for Sandy Oats.
William Webster, Kirkside, for Chevalier Barley.
Andrew Longmore, Rettie, for Lord Western's Barley.
Alexander Morrison, jun., Turriff, for Rye-Grass Seed.

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* **Half Premiums awarded, the number of lots being under six.**

The District of Wester Ross.

John Binning, Brae, for White Essex Wheat.
John Polson, Moy, for Chevalier Barley.
Allan Cameron, Dreim, for Sandy Oats.
John Mackenzie, Kinettas, for Perennial Rye-Grass.

The County of Elgin.

George Cruickshank, Barnhill, for White Wheat.
William Dickson, Alves, for Chevalier Barley.

GREEN CROPS ON SMALL POSSESSIONS.

The Parishes of Kenmore and Killin.

1. Duncan Campbell, Kiltyrie, ...	L.3	0	0
2. John M'Laren, Machuim, ...	2	10	0
3. Widow Campbell, Margbeg, ...	1	10	0
4. John Stewart, Ardradnaig, ...	1	0	0

The Parish of New Pitsligo.

1. Charles Mackie, Balnamoon, ...	L.3	0	0
2. Charles Beange, Balnamoon, ...	2	10	0
3. James Birnie, Cairnheigh, ...	1	10	0
4. Joseph Horn, Cairnywhing, ...	1	0	0

MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

The Silver Medal has been awarded to the following parties :—

The District of East Kilpatrick.

1. William Lang, Blairdardy, for Best-managed Green Crop.
2. Gavin Marshall, Gartconnell, for Best-managed Farm.

The District of Breadalbane.

1. James Anderson, Dunaves, for Best-managed Green Crop.
2. Peter Sinclair, Margnacrannaig, for Best-kept Dunghill.

The District of Clackmannan.

1. A. & A. Mitchell, South Parkhead, for Best-managed Green Crop. (*Dryfield*).
2. A. & A. Mitchell, Kennetpans, for Best-managed Green Crop. (*Carse*).

The District of Bute.

William Johnston, West St Colmack, for Best-managed Green Crop.

The District of Leochel-Cushnie.

John Dunn, Wester Enentyre, for Best-managed Green Crop.

PLOUGHING COMPETITIONS.

In the course of the year the Society's Medal was awarded at 87 Ploughing Competitions, the details of which are given in a previous part of this volume.

COTTAGES AND GARDENS.

FOR THE BEST-KEPT COTTAGES AND GARDENS.

First Cottage Premium—L.1, 5s., and Medal when Four Competitors; Second,—L.1; Third,—15s. First Garden Premium—L.1, 5s., and Medal when Four Competitors; Second,—L.1; Third,—15s.

The County of Forfar.

CRAIG.—1st Cottage Premium and Medal, to James Adams; 2d, Walter Smith; 3d, John Oswald. 1st Garden Premium and Medal, James Adams; 2d, Charles Falconer; 3d, John Oswald.

The County of Lanark.

LESMAHAGOW.—1st Cottage Premium and Medal, to Thomas Brown; 2d. William Ritchie; 3d, Thomas Symington. 1st Garden Premium and Medal, Thomas Brown; 2d, W. Ritchie; 3d, John M'Intosh.

The County of Wigtown.

OLD LUCE.—1st Cottage Premium and Medal to Wm. Hamilton; 2d, James Hannah; 3d, Margaret Galloway. 1st Garden Premium and Medal to Peter Agnew; 2d, James Hannah; 3d, Margaret Galloway.

MEDALS GIVEN IN AID OF PRIVATE COMPETITIONS.

On the Linlithgow Agricultural Society's Application.

To George Bird, Easter Carlowrie, for Best-kept Cottage.

On Lord Kinnaird's Application.

1. John Sim, for Best-kept Cottage—Lower district.
2. Thomas Prain, for Best-kept Cottage—High district.

On Mrs Douglas Baird of Closeburn's Application.

1. To Mrs J. M'Murdo, for Best-kept Cottage.
2. To William Bisset, for Best-kept Garden.

On the Eastern District of Stirlingshire Association's Application.

Alexander Miller, The Island, for Best-kept Cottage.

The Parishes of Lanark and Covington.

1. William Purdie, Covington, for Best-kept Cottage.
2. Do. do. for Best-kept Garden.

VETERINARY COLLEGE.

Silver Medals were awarded, at the annual examination in April last, to the following parties:—

1. To Edward Coleman, Sitton, Surrey, for Best General Examination.
2. To Thomas Strangways, for an Essay on Opium.
3. To Edward Coleman, Sitton, Surrey, for an Essay on Opium.
4. To Charles Bradshaw, Mauritius, for an Essay on Carbon.
5. To Walter Lewis, Great Badworth, Cheshire, for General Efficiency.
6. To George Morgan, Alvah, Banff, for Best Examination in Anatomy.
7. To James Kirby, Sibsey, Lincolnshire, for Best Anatomical Preparation.
8. To William Williams, Holywell, for Best Examination in Chemistry.
9. To William A. Field, Eastergate, Chichester, for Best Examination in Materia Medica.

All Premiums, not applied for within two years from the term of payment, will be forfeited.

By order of the Directors,

J^N^. HALL MAXWELL, *Secretary.*

EDINBURGH, *10th February*, 1857.

On the MANURES which can be most advantageously employed as SUBSTITUTES for GUANO.

By Dr Anderson, Chemist to the Society.

An Address delivered at the Monthly Meeting on the 18th February 1857.

The price of artificial manures, and their fluctuations in value, are questions of the highest importance to the farmer, and have every year been forcing themselves more and more strongly on his attention. The steady increase in the price of guano has rendered their relative economy infinitely more important than it was, so long as that substance could be obtained on moderate terms; and now that a further and very considerable increase in its price has taken place, the question has acquired a very different aspect, and it comes to be a matter of consideration whether the farmer can any longer afford to employ it; and if so, by what substances it can be most advantageously replaced. In bringing these points under the notice of the Society, I shall, even at the risk of repeating matters already familiar to many of our members, commence by a short recapitulation of the mode in which manures act, for the purpose of pointing out what is required both for a general and a special manure, and thus laying down some fixed principles on which we may judge how far guano and similar substances fulfil what is required of them. The great fundamental principle on which a manure is employed depends upon the fact that every plant during its growth accumulates in its system a certain quantity of matters essential to its existence, which it derives partly from the soil and partly from the air. From the former it extracts the fixed mineral matters which exist there, and there only, while from both it obtains supplies of its organic food, that is, of the water, carbonic acid, ammonia, and nitric acid, required to build up that greatly preponderating portion of its mass which is combustible. Plants grow naturally without cultivation, because the soil and the air always contain a certain quantity of the elements they require; and as they either die in the spot where they grew, or are consumed by wild animals, these substances sooner or later find their way back to the soil, there to commence a new cycle of similar changes, so that a certain moderate production continues from year to year. But when agriculture comes into operation, these conditions are changed; the crop is removed from the soil, and consumed elsewhere; and though the air will still afford the elements which are derived from it as abundantly as before, the next generation of plants must find in the soil a diminished supply of the substances it obtains from thence. The necessary consequence is, that if the cultivation of plants be continued, the quan-

tity of valuable matters in the soil becomes less and less, until at length the soil is so much reduced as to be no longer sufficient to maintain the growth of plants, and it is then said to be exhausted. To restore the fertility of such an exhausted soil, vegetable matters, or the dung of animals, which consists to a large extent of partially decomposed vegetable matters, must be returned to the soil; and herein lies the simplest, the oldest, and the most generally employed method of manuring, and the only one possible, so long as the principles on which a manure acts were unknown. But now that the progress of scientific knowledge has enabled us, in place of considering farmyard manure as a whole, to estimate the advantages derived from each of its numerous constituents, we have come to see that it may not in all cases be an indispensable manure, but may to a certain extent be replaced by other substances. In fact, when we inquire more minutely into the cause of the diminished fertility of a soil from which a succession of crops has been removed, it is found rarely to depend on the general exhaustion of all the requisite elements, but most commonly on the deficiency of one or more substances, which have been removed by a certain number of crops, while the others still remain in sufficient abundance. And hence, the fertility depends not so much on those substances which are abundant, as on those which are most deficient, and the absence of which renders the others useless, because the plants cannot grow without an adequate supply of *all* their constituents. A soil in this condition does not absolutely require farmyard manure, but may be again made to produce abundant crops by the application of the one deficient substance, which is then called a special manure. When so treated, a soil will retain this renewed fertility for a certain time, but at length becomes again infertile, even under a continued application of this manure, which is then said, in ordinary language, to have lost its effect, although the real reason is that the supply of a second constituent has been exhausted, and it also must be supplied in the form of a manure. In all that precedes, we have supposed it to be required merely to keep up a certain moderate fertility, such as an ordinary soil may be supposed to possess in a state of nature. But agriculture does a good deal more than this, and seeks to produce a larger amount of vegetation than the natural soil can do without extraneous aid, an effect which may manifestly be always produced by supplies of farmyard manure, sufficient to afford a superabundance of all the different constituents of plants. But it is obvious that we may succeed equally well without it, if, as will frequently happen, some of the constituents be abundant, and their utility be limited by the deficiency of only one or two. Thus, for instance, we may conceive a soil containing a superabundance of all the mineral elements of the plant, but no ammonia or other

nitrogenous matter, in which case the produce will be limited by the quantity of ammonia which the plants can obtain from the air during their period of growth, and may be greatly increased by a special manure, containing nothing but that substance; so likewise it may happen that even where farmyard manure has been applied in very large quantity, the addition of a special manure may still be advantageous, because, as ordinary dung consists of the constituents of plants, minus those substances which have been retained by the animals which fed upon them, it may be desirable to supplement deficiencies so produced; or if the crop to which it is applied happen to require an unusually large quantity of any particular element, it may be advisable to add an extra quantity of that substance, so as to bring out the full effect of its other constituents. It cannot fail to be observed that, according to the definition now given, there is a very important distinction to be drawn between a general and a special manure. When the former is used, all the constituents of plants are added to the soil, and not only is its fertility maintained, but, if they be used with sufficient liberality, its productive capacity may be materially increased. Whereas, on the other hand, a special manure adds nothing to the permanent fertility of the soil, but only renders its existing constituents more rapidly available, and hastens rather than defers its exhaustion. Such at least would be the case if special manures were employed alone, a method rarely practised, and which, in my opinion, should be scrupulously avoided, except under very special circumstances. But if special manures be employed along with farmyard manure, the result is different. A given quantity of the latter can of course produce only a certain amount of crop, but if mixed with a special manure, it is more rapidly converted into vegetable matter, and this is advantageous to the farmer. It may be urged that this is a matter of little moment, and that sooner or later the farmer receives back what he has put into the ground. But this is not the case; during six months of the year manure lying in the ground is undergoing decomposition, although there are no plants to make use of it, and the constituents then set free are in part at least washed away and lost. Even if none of it were lost, it would not be altogether a matter of indifference; for to take an extreme case by way of illustration, if we suppose a part of the manure to remain undecomposed for 14 years after its application, it will, if only 5 per cent interest on its price be reckoned, have cost the farmer twice as much as that which was consumed during the year of its application. While, therefore, I consider the use of special manures alone a most injudicious and shortsighted policy, which can rarely be employed with advantage, there is no question that their proper combination with farmyard manure is really one of the most important improvements ever introduced

into the practice of agriculture. If the principles now laid down be applied to the estimation of special manures, we see that the substances most advantageously applicable are those rich in the constituents in which the soil or farmyard manure are most commonly deficient, or which serve to promote the rapid absorption of those they do contain. Chemistry alone does not enable us to arrive at a certain knowledge of these points, but must be supplemented by the results of field experience; for the question does not entirely depend upon the proportion in which these substances are present, but to a very great extent also in the degree to which they are immediately available to the plants. The results of analysis, however, have shown us that there are two substances always existing to a very small extent in the soil, namely, ammonia and phosphoric acid, and a third, namely, potash, which is rarely very abundant;* while all three are most important constituents of plants. The results of precise experiments in the field, as well as everyday practice, show that the two former are also most important and essential constituents of special manures, and invariably remunerate the farmer for the expense of application. In regard to potash, our information is much more limited; but what we do know leads to the conclusion that its salts are very uncertain in their results. Experiments made two years since at the instigation of the Highland Society, showed that sulphate and muriate of potash produced little or no effect on grain crops, but great anticipations were formed of the advantage of applying them to potatoes, which, however, have not been confirmed during the past season; and an experiment with carbonate of potash, by the late Mr Pusey, also proved unfavourable. A special manure must be valuable, therefore, exactly in proportion as it contains these substances, and especially the two former of them, and hence it is that guano maintains so high a position among fertilisers. If, then, it be wished to compare with one another a number of different manures, all that we have to do is to observe the relative quantities of these substances; and if we wish to calculate its money value, it is only necessary to ascertain the prices at which those substances can be purchased in the market; all of them being obtainable as commercial articles in some form or other. Agricultural chemists have endeavoured, as far as possible, to fix the market value of the different constituents of manures, and have arrived at results which differ somewhat from each other. The following table gives the value per ton attached to the principal constituents of such manures, by Mr Way, Dr Hodges, Mr Nesbit, and myself :—

* The quantity of potash is sometimes not more than twice as large as the phosphoric acid; but in other cases it is ten and even twenty times as abundant.

	Way.			Hodges.			Nesbit.			Anderson.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Ammonia, ...	56	0	0	56	0	0	60	0	0	56	0	0
Insoluble phosphates,	7	0	0	7	0	0	8	0	0	7	0	0
Soluble phosphates, .	32	13	0	25	0	0	24	0	0	28	0	0
Potash,*	30	16	0	20	0	0		...		20	0	0
Alkaline salts, . . .	1	0	0	1	0	0	1	0	0	1	0	0
Organic matters, . .	1	0	0	0	10	0	1	0	0		...	

These are supposed to represent fair average prices, but that of ammonia is rather under the present market price, which is at present from £60 to as high as £68 per ton. Further, it is to be noticed that though potash is stated, it is very doubtful whether, owing to the uncertainty of its action, it ought to be generally estimated. The same is true of the organic matters, which exist in the soil and the farmyard manure so abundantly, that the few pounds added to an acre in the portable manures do not merit notice. For this reason I do not reckon organic matters or potash, except in a manure which is deliberately used for the purpose of applying it. To come now to the more immediate subject of discussion, we must, before attempting to discover what are the best substitutes for Peruvian guano, endeavour to define its true value, which the preceding tables enable us to do. An average Peruvian guano contains :—

Water, ...	13.73
Organic matter and ammoniacal salts, ...	53.16
Phosphates, ...	23.48
Alkaline salts contain 3.00 of potash, ...	7.97
Sand, ...	1.66
	100.00
Ammonia, ...	16.5
Phosphoric acid in the alkaline salts equal to 5.21 phosphate of lime, ...	2.50

and calculating from the preceding tables, its value per ton is, according to

Way, ...	£13 19 0
Hodges, ...	13 0 0
Nesbit,†	13 12 0
Anderson, without potash, ...	12 8 0
Do., with potash, ...	13 0 0

* Mr Way's valuation for potash is certainly much too high, and even that adopted by Mr Hodges and myself is considerably above the price at which it can be obtained from kelp. Cut-weed kelp, containing about 18 or 20 per cent of potash, can be purchased for from £2, 10s. to £3 per ton. At the latter price, even if we put no value on any of the other constituents of the kelp, potash costs only about £15 per ton. If we allow the ordinary value of the sulphate of soda, common salt, and phosphates, contained in kelp, the cost of the potash is under £13 per ton.

† Mr Nesbit gives no value for potash in his list, and hence it must be supposed

It may be urged against these calculations that the prices assumed are not exactly those which must be paid for the different substances, and that at least ammonia is estimated considerably under its present market price. Let us see, therefore, what is the actual cost at which a similar mixture could be produced at the present time, assuming £68 per ton as the price of ammonia, £8 for phosphates (at which high rate Mr Nesbit reckons them), and £13 for potash, as obtained from kelp; we then find that we have for 100 tons as follows:—

53	tons organic matter at	£1	£53
23.5	tons phosphate at	8	188
3	tons potash at	13	39
5.21	tons soluble phosphates at	28	145
16.5	tons ammonia at	68	1120
			£1545

Or at the rate of £15, 9s. per ton, estimating at the present high market prices of all its constituents. At the present moment guano is selling in quantities under 30 tons at from £14, 15s. to £15 per ton, and it may therefore be alleged that this is still under its value. But an extension of the principle of valuation on which we have been proceeding will at once show the fallacy of this. If, for example, we calculate the value of farmyard manure according to the prices assumed for guanos, we find that the organic matter is obtained for nothing, and the farmer who is about to use 20 loads of that manure to an acre of his land, may with justice say to the guano merchant, "I am applying to the acre 3 or 4 tons of organic matter, which costs me nothing, and I cannot therefore be expected to pay at the rate of £1 per ton for the couple of cwts contained in guano, neither can I pay for potash, which, so far as we have been able to see, produces comparatively little effect;" and this at once cuts off 18s. per ton from the value. Moreover, it is to be noticed that all the calculations refer to the value of an average sample, but the importers give no guarantee that the guano, as delivered by them, shall come up to this; all that they promise is, that it shall be sound and unadulterated; and should it happen that a cargo contains only one per cent less of ammonia, phosphates, and alkaline phosphates, its value is diminished by almost exactly £1 per ton, although no reduction is made on its price. Of course, so long as guano could be obtained at £9 or £10, which is clearly quite within its value, this was a matter of no moment, for the purchaser always got value for his money, although he might sometimes have a better bargain than at others. But now that the price is so high, it is only just that a fixed proportion

does not estimate it in a guano, a system in which I concur, although I have calculated the value both with and without. If we exclude potash and organic matter, Mr Way's valuation would be reduced to £12, 10s. per ton.

of all its constituents should be guaranteed. I have entered into these details regarding the valuation of guano, because they appear to me to be calculated to some extent to allay the apprehensions now existing among farmers, by showing that the present price of guano cannot possibly be maintained. But this does not in any degree lessen the importance of introducing proper and useful substitutes for it. The subject is one to which I have for some time past paid considerable attention, and long before the present rise in the price, I had come to the conclusion that a far too exclusive reliance had been placed in guano. In making these observations, I trust I may not be misapprehended, or supposed to wish to depreciate guano, of which I am sure no one who has attended to the opinions I have frequently expressed at the meetings of this Society will accuse me. But I feel convinced that guano has frequently been used where other manures would have produced an equally good result at a less cost. Prominent among these stands superphosphate, both because of its results in the field and because it can be, and is, manufactured in large quantities. In a recent number of the *Transactions of the Highland Society*, I have entered so fully into the composition and valuation of this manure, that it will be unnecessary for me to recur to it here, farther than to point out that a good superphosphate is sold at a price rather under the market value of its constituents. A good sample may contain—

Water,	16.64
Organic matter,	12.04
Soluble phosphates,	20.11
Insoluble phosphates,	16.51
Sulphate of lime,	9.15
Sulphuric acid,	18.52
Alkaline salts,	2.76
Sand,	4.27
	100.00
Ammonia,	1.55

Estimating according to Mr Way's plan, this superphosphate would be worth £8, 16s. per ton; according to my own, £7, 12s.; or with ammonia at its present high market price, £7, 16s., and it would probably be sold at £7, 10s. Such a superphosphate, applied weight for weight, would, I apprehend, produce a result little inferior to Peruvian guano, at not much more than half the price. I believe, however, that all this could be done at a still lower price were farmers to manufacture their own superphosphate—a plan which will sooner or later be adopted. No doubt the impression is general that this process can be most economically effected by a manufacturer, and is not profitable for the farmer; but this is chiefly because the latter have always tried bones, which are both expensive and difficult to dissolve, and have never used the most convenient materials, such as bone-ash, which would have led them to a different conclusion, as may be easily seen from a very

simple calculation. Bone-ash, containing 75 per cent of phosphates, sells at £6 per ton, but let us take it as costing the farmer £7, and sulphuric acid of specific gravity, 1.7, technically called "pan-acid," costs at present £5, 6s. per ton, which is unusually high. One ton of this acid, and about ¼ ton of water, would be requisite to dissolve 2 tons of bone-ash, and the product would cost £5, 18s. per ton, and contain 46 per cent of phosphates, at least one-half of which would be soluble, but no ammonia. If the bone-ash could be got at £6 per ton, and pan-acid at £4 (which is not an unusual case), the superphosphate would cost only £5, 10s., while its value estimated in the usual way would not be less than £8 per ton. Ammonia might be added to this substance in the form of sulphate, at a cost of about £1 for every 1.5 per cent; but whether this would be profitable, I am not prepared to state, as it could only be determined experimentally, and there is no matter which, under present circumstances, it would be more important to submit to careful experiment during the coming summer. Should it turn out that ammonia may be dispensed with in a manure for turnips, then a most important point will have been established, and there will be every prospect of a diminution in the price of such manures. In fact, the sources from which phosphates can be obtained are undergoing great extension, though perhaps scarcely commensurate with the demand, and hence there has been a material increase in their cost, and in the case of coprolites an unreasonable advance. Within the last few weeks, however, it has been announced that these substances are found in enormous quantities in France; and should this prove correct, there can be little doubt that it will influence prices. They appear to be very similar to those found in England. There is no doubt, then, that superphosphate will be the substance to which farmers will, in the first instance, have recourse, both because it is well known to produce good results, and to be obtained in large quantity. But then it may happen that the demand exceeds the supply, and in this case there would come to be a rise in price. It will not do, therefore, to rely upon it entirely, and attention must be turned to other substances. Neither must it be forgotten that phosphates, however important, are only one of the elements of plants, and have been found to exert a more important influence on the turnip on particular soils than any other element. In fact, to propose the use of them, is only to substitute one manure for another, and not to increase the total quantity of fertilisers at the disposal of the farmer, which is the true and only method in which a permanent depression of prices can be produced, for, as I have already observed, they appear at the present moment to have reached their maximum. The reduction of the price of ammonia and phosphates is in fact the reduction of the price of manures, and it can be effected either by increasing the supplies, or by the better economy of those which

we at present have. We have already referred to the discovery of coprolites in France, as one mode in which the quantity of phosphates can be increased, and their price in all probability diminished; but I am inclined, on the whole, to give greater weight to the increase and cheapening of ammonia. The great source of ammonia on which we at present rely, is the manufacture of gas, and the cheapest commercial form of a pure ammonia compound is the sulphate. Now, when £17 per ton is paid for that salt, the greater portion of the price goes for the sulphuric acid—which, so far as we know, has no agricultural value, and at all events could be obtained much more cheaply from other sources—and the cost of manufacture. The ammoniacal liquor of the gas-works, after having been once distilled, can be obtained, containing 20 per cent of ammonia, at a price which gives that substance at from 3d. to 3½d. per pound, or about £28 per ton. The objection to its agricultural use is a very obvious one; the ammonia exists there chiefly as carbonate, and in that state is peculiarly liable to loss by evaporation into the air, and it is universally admitted that it ought to be fixed by sulphuric acid. It is to be observed, however, that we have no information of a satisfactory kind regarding the loss which the carbonate of ammonia actually does undergo. We know that a certain proportion of the ammonia in Peruvian guano is in that form of combination, but the amount of loss it suffers on that account is not known. It is clear, however, that if concentrated gas-liquor were applied to the soil, the farmer could afford to lose one-third of it, and still have his ammonia cheaper than in the state of sulphate. We have at present no data bearing on this point, but it is well known that ammonia runs most risks when applied on the surface, and that if it be incorporated with the soil, it is retained by it. In fact, it is now well known that the very first action of a soil upon a salt of ammonia, is to decompose it, to extrude its acid and detain its base; so that we actually manufacture at a large expense a salt which is immediately destroyed again. I would suggest, therefore, as an experiment which may have most important bearings on the economy of manures, the trial of this fluid. I should propose the application at the rate of 2 to 3 cwt. to the acre on grain crops, both alone and mixed with a certain quantity of bone ash, and I would suggest that the land should be made up in ridges, and the solution, diluted to a proper extent, poured into the bottom of the furrows, while the plough, immediately following the application, should be made to divide the ridge, and cover the ammonia. This I should propose to do several days before sowing, for I apprehend it would not answer to put the seed near the strong ammoniacal fluid, and a few days should be allowed for it to disseminate itself through the soil. I throw this out as a suggestion for the consideration of farmers; and though it is quite possible that this method of appli-

cation may be too expensive in practice, or that the ammonia may not operate as effectually, it is certainly worthy of trial. 1½ cwt. of the ammoniacal fluid, and the same quantity of bone-ash, might also be tried on turnips; and should these applications prove successful, it will be possible to make a mixture as good as Peruvian guano, at a cost of not more than £8 per ton. There are many other sources from which nitrogenous matters might be obtained, which are now much neglected, among which I may suggest dead horses and cattle, refuse hair, &c. &c., and last, not least, urine. It is always a source of regret to me to see the construction of our railway and other urinals, in which a large quantity of ammonia is daily washed away into the sewers, where it becomes practically almost useless to agriculture. If in place of using water to wash it away, the smell was prevented by the use of disinfecting powders or charcoal, which would be much more effective than the present method, and the produce collected in tanks, it might then be evaporated with a little sulphuric acid, and would produce a very valuable manure, containing a considerable quantity of soluble phosphates and alkaline salts. This process was at one time practised in Glasgow, but was discontinued, chiefly, I believe, because the neighbours threatened to indite it as a nuisance. The material was collected at the different manufactories of the town, and carried to the works in casks, and I believe that though a price was paid for it, the process was profitable. I have often asked myself whether in a town like Edinburgh, where the levels are suitable, it might not be possible to connect those places by a separate system of pipes, and convey all the produce to a manufactory, where it might be evaporated with sulphuric acid. I cannot help thinking that it might prove successful, for the manure would undoubtedly be worth £8 or £9 per ton. The conversion of fish refuse and coarse fish into a manure is also deserving attention. There is no doubt that many fish which are unavailable for human food are annually caught on our coasts, which are never brought on shore, but are at once returned to the sea. If those fish were brought to land, cut into thin slices, which could be easily done by the fishermen's families, and then laid out to dry on the stones, after sprinkling with a little salt, the dry mass would be worth about £6 or £7 per ton. All these are matters which merit attention; and should the present crisis lead to any of them being made available to agriculture, its effects will be more beneficial than otherwise. There is one other way in which it will act beneficially, for it will direct more attention to the economy of farmyard manure, which I believe to be one of the most backward departments of agricultural practice, and which has been kept back, to a great extent, by the cheapness of portable manures. Farmyard manure, except on the farms of the best agriculturists, is very much what it was a century ago, and there are few who could not introduce im-

provements. To this day nearly one-half of it is destroyed and wasted by keeping it in a state of active fermentation. Chemists have always strongly opposed this plan. Sir Humphrey Davy did so in his well-known lectures, and no point advocated by him was more strongly animadverted on by farmers at the time. I have on several occasions referred to this matter at the meetings of the Society, and I do so again under the hope that the subject may now obtain attention, the more especially as Dr Voelcker has recently shown that the loss is really very great. All these matters to which I have referred must have their effect sooner or later on the price of light manures; but this must not prevent every means being taken to reduce their price, and the agricultural community should urge upon Government the importance of sending out special expeditions in search of guano, nitrate of soda, and all other substances which can be used as manure. And not only that, but rewards should be offered to private discoverers, as at present there is little inducement to any one to search for these substances, for he cannot keep his secret sufficiently long to make a profit of it. A sum of £10,000 would cheaply repay the discovery of a deposit far inferior to Peruvian guano. The production of cheap food is a matter of the highest importance to the welfare of a country; and to do this, cheap manures are now indispensable.

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PREMIUMS

OFFERED BY

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

IN

1856.

CONTENTS.

PRELIMINARY NOTICE.

When the Highland Society was instituted in the year 1784, and established by Royal Charter in 1787, its objects, comparatively, were few, and their operation was limited to matters connected with the amelioration of the Highlands of Scotland.

The patronage of certain departments, proper to that part of the country, having been subsequently committed to special Boards of Management, or undertaken by other Associations, several of the earlier objects contemplated by the Society were consequently abandoned, while the progress of Agriculture led to the adoption of others of a more general character.

The exertions of the Society, instead of being restricted to the improvement of the Highlands, were early extended to that of the Lowlands, and have in both, for above seventy years, been directed to the promotion of the science and practice of Agriculture, in all its branches.

In accordance with this more enlarged sphere of operation, the original title of the Society was altered, under a Royal Charter in 1834, to The Highland and Agricultural Society of Scotland.

The leading purposes of the Institution are set forth in the following pages, where it will be found that Premiums are awarded for Reports on almost every subject connected with the cultivation of the soil; the rearing and feeding of stock; the management of the dairy; the growth of timber; the extension of Cottage Accommodation; the improvement of Agricultural Machinery and Implements; and the dissemination of Veterinary information.

Among the more important measures which have been effected by the Society, are,—

1. General Cattle Shows and Agricultural Meetings, held successively in different localities, at which exhibitors from all parts of the United Kingdom are allowed to compete.

2. A System of District Shows, instituted for the purpose of improving the Breeds of Stock most suitable for different parts of the country, and of aiding and directing the efforts of Local Agricultural Associations.

3. The advancement of the Veterinary Art by the establishment of a College in Edinburgh, where the Society's Diploma is conferred on Students who have passed through a regulated curriculum of study, and are found qualified to practise after a rigid examination.

4. The appointment of a Chemist for the purpose of promoting the application of science to Agriculture. Investigations on subjects of importance are conducted in the Laboratory, and published in the Transactions. Members have the privilege of applying for analyses of Soils, Manures, &c., on favourable terms.

5. The establishment of an Agricultural Museum illustrative of the vegetable products of the country.

6. Monthly Meetings during the Winter Session for the discussion of Agricultural subjects.

7. The organization of a system, under which the Agricultural Statistics of Scotland have been successfully obtained and reported to Government.

8. The periodical publication of the Transactions, which comprehend the proceedings in the Laboratory, Reports of Experiments, and other communications addressed to the Society. The Transactions are published by Messrs Blackwood and Sons, Edinburgh, along with the Quarterly Journal of Agriculture.

CONSTITUTION AND ESTABLISHMENT.

The affairs of the HIGHLAND AND AGRICULTURAL SOCIETY are conducted under the sanction and control of a Royal Charter, which authorizes the Enactment of Bye-Laws.

The Office-Bearers consist of a President, four Vice-Presidents, ten Extraordinary, and thirty Ordinary Directors, a Treasurer, and an Honorary and an Acting Secretary.

The proceedings of the Directors are reported to Half-yearly General Meetings of the Society, one of which is, by the Charter, appointed to be held on the second Tuesday of January, and the other on such day in the months of June or July as the Directors may fix.

New Members are admitted at either of these General Meetings by Ballot. The ordinary subscription is £1, 3s. 6d. annually, which may be redeemed by one payment varying from £12, 12s. to £7, 1s. Tenant Farmers are admitted on a subscription of 10s. annually, or £5, 5s. for life.

The Premiums awarded by the Society are payable after the 10th February for the preceding year. Orders, payable at the Royal Bank of Scotland, are issued at the Society's Hall, on the stamped receipt of parties to whom the Premiums have been adjudged being presented, or receipts may be transmitted through a Bank, addressed to the Secretary, if done without expense to the Society. The receipt must specify distinctly the Premium in discharge of which it is sent.

Premiums not applied for within two years from the term of payment will be forfeited.

All communications are to be addressed to the Secretary of the Society, 6 Albyn Place, Edinburgh.

ESTABLISHMENT FOR 1856.

President.

HIS GRACE THE DUKE OF HAMILTON AND BRANDON.

Vice-Presidents.

THE MARQUIS OF STAFFORD.
LORD LOVAT.
THE EARL OF ELGIN, K.T.
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GEORGE MITCHELL INNES of Ingliston.
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Chairmen of Standing Committees.

Argyll Naval Fund,	ALEXANDER LAMONT of Knockdow.
Chemistry,	WILLIAM GREGORY, M.D., Professor of Chemistry in the University of Edinburgh.
Cottages,	ROBERT G. BAILLIE of Culteraliers.
District Shows,	ROBERT MACLACHLAN of Maclachlan.
Finance,	ANTHONY MURRAY of Dollerie.
General Shows,	DONALD HORNE of Langwell.
House and Buildings,	JAMES ANSTRUTHER, Moray Place.
Machinery,	JOHN MILLER of Leithen.
Museum,	JOHN HUTTON BALFOUR, M.D., Professor of Botany in the University of Edinburgh.
Premiums,	DAVID LOW of Laws.
Publications,	ALEX. FORBES IRVINE, younger of Drum.
Veterinary College,	JOHN GOODSIR, Professor of Anatomy in the University of Edinburgh.

Monthly Meetings.

The DUKE OF BUCCLEUCH, K.G., *Chairman.*
A. C. GIBSON-MAITLAND, Bart.; Sir JOHN M'NEILL, G.C.B.; DAVID LOW of Laws; and DAVID MILNE HOME of Wedderburn, *Deputy-Chairmen.*

PREMIUMS.

GENERAL REGULATIONS FOR COMPETITORS.

All Reports must be legibly written on only one side of the paper, and must specify the number and subject of the Premium for which they are in Competition; they must bear a distinguishing motto, and be accompanied by a sealed letter similarly distinguished, containing the name and address of the Reporter; initials must not be used.

None of the sealed letters, except those relative to Reports found entitled to at least one-half of the Premium offered, will be opened without the Author's consent.

Reports, for which a Premium, or one-half of it, has been awarded, become the property of the Society, and cannot be published, in whole or in part, nor circulated in any manner, without the consent of the Directors. All other papers will be returned to their Authors if applied for within twelve months.

When a Report is unsatisfactory, the Society is not bound to award the whole, or any part of a premium.

All Reports must be of a practical character, containing the results of the writer's own observations or experiment. Papers compiled from books will not be rewarded.

Weights and Measurements must be indicated by the new or imperial Standards. The decisions of the Board of Directors, confirmed by the Society, are final and conclusive as to all Premiums whether offered for Reports, or at General or District Shows, and it shall not be competent to raise any question or appeal touching such decisions before any other tribunal.

Reports on subjects not included in the Premium List, will be received, and honorary awards will be given, when merited.

CLASS I.

REPORTS.

Section 1. ON SUBJECTS CONNECTED WITH THE SCIENCE AND PRACTICE OF AGRICULTURE.

1. MANAGEMENT OF HOME FARMS.

For an approved Report on the best mode of managing a Home Farm, affording an example of high farming combined with profit—The Gold Medal, or Ten Sovereigns.

The Report should contain a full description of the Farm—of the system on which it has been managed and cultivated—and of the improvements that have been effected; the outlay and expenditure should be given, and the mode of accounting explained. The Report should further advert to the best training and education for a Steward—the qualifications he more particularly requires—and the powers with which he should be entrusted.

Reports to be lodged by 1st November 1856.

2. DRAINAGE OF SHEEP FARMS.

For an approved Report on the best system of draining Sheep Farms in mountainous districts—The Gold Medal, or Ten Sovereigns.

The Report, while based on practical observation and actual operations, must consider the general principles which should regulate the drainage of pastoral districts, the probable outlay, and the returns that may be looked for.

Reports to be lodged by 1st November 1856.

3. RIVER EMBANKMENTS.

For an approved Report on the best methods of embanking and otherwise protecting low lands adjoining rivers and burns from floods, as well as for protecting the natural banks of streams from injury and dilapidation—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1856.

4. COTTAGES.

For an approved Report on the best construction and arrange-

ment, and on the most suitable fittings for Labourers' Cottages in different districts, and under different circumstances—The Gold Medal, or Ten Sovereigns.

The Report must state the principles which should regulate the character of the accommodation most suitable for different districts and circumstances. The internal fittings must be described, and the applicability and expediency of all recent improvements must be considered.

The Report must be illustrated by drawings or plans, and must embrace statements of cost.

Reports to be lodged by 1st November 1856.

5. DEEP PLOUGHING.

For an approved Report on the comparative results obtained by the following modes of Ploughing:—1*st*, By the Common Plough, with a furrow not less than eight inches; 2*d*, By the Common, or the Trench Plough, with a furrow not less than ten inches; 3*d*, By the Subsoil Plough—The Gold Medal, or Ten Sovereigns.

The land operated on must have been thoroughly drained. The Report must state the nature of the soil and subsoil, and the date, depth, and expense, of each ploughing. The extent of land to be not less than one acre for each operation, and, on each lot, the produce of two separate portions, of not less than 20 poles, to be weighed or measured. In every other respect than ploughing the whole land to be treated alike.

Reports to be lodged by 1st November 1856.

6. SPECIAL MANURES.

Fifty Sovereigns will be awarded in such proportions as the Directors may see proper:—

1. For an approved Report of experiments made with different manures, either separately or mixed in certain proportions, and applied either in solid or fluid form.

It is necessary that the land on which the experiments are to be made shall be of as equal quality and exposure as possible, and that, in the preceding rotation, the whole shall have been treated in every respect alike. Each experiment must be made on two ridges, and the results compared with those obtained from two ridges adjoining, which shall have been manured in the ordinary

manner of the farm. Each ridge must contain at least a quarter of an acre. These experiments to be made in duplicate, either in the following form, or as near it as the conditions of the experiment will permit.

1	2	Manured in the ordinary manner of the Farm.	3	4	Manured in the ordinary manner of the Farm.	5	6	Manured in the ordinary manner of the Farm.	7	8
5	6		7	8		1	2		3	4

The substances employed may be Guano, Nitrate of Soda, Nitrate of Potash, Sulphate of Soda, Sulphate of Magnesia, Sal-Ammoniac, Sulphate of Ammonia, Soda Ash, Pearl Ash, Kelp, Bones, Soot, Coal Ashes, or mixtures of these in specified proportions, and any others of known composition, which the experimenters may select. Poudrette or Prepared Night-Soil, and the Ammoniacal liquor of Gas-Works, should also be tried; and it is particularly recommended that the refuse of Manufactories, such as the Prussiate of Potash,—the refuse of Sugar-Works, Salt-Works, Bleach-Works, and Glue-Manufactories, should be collected and experimented upon. But it is recommended that the experimenter should confine himself to a small number of substances, as, in estimating the value of the papers, the judges will give a preference to a limited number of experiments which supply definite conclusions, over a larger number which do not lead to precise results.

The following is a list of the equivalents of the different salts above mentioned :—

Nitrate of Potash, . .	101·3
Nitrate of Soda, . .	85·4
Sulphate of Potash, . .	87·2
Sulphate of Soda, dry, . .	71·6
Sulphate of Ammonia, . .	66·0

Sal-Ammoniac,	53·5
Carbonate of Potash (Pearl Ash),	69·2
Carbonate of Soda (Soda Ash),	53·4
Sulphate of Magnesia, crystallized,	123·8
Sulphate of Lime (Gypsum),	86·6

In explanation of this list, experimenters should understand, that if they have resolved to make an experiment, say with 101 lb. of nitrate of potash, they ought to contrast it not with 101 lb. of nitrate of soda, but with 85·4 lb., and if any other quantities are fixed upon, their relation can be readily calculated by the rule of three.

When experiments are made with mixtures, the proportions of the several substances must, in all cases, be stated.

The quantity by weight, and the cost of the manures employed, as well as the quantity, quality, and marketable value of the crop produced by each, must be accurately ascertained and reported; the nature and qualities of the soil, its altitude, exposure, drainage, and such other particulars and observations as the Reporter may deem deserving of attention, must be stated.

The value of the experiments will be enhanced, if accompanied with an analysis or minute description of the soil on which they are made, and means of proving the purity of the manures which were used.

The experimenter is further recommended to transmit, along with his report, samples of not less than 1 lb. weight of all the manures employed.

Reports to be lodged by 1st November 1856.

2. For an approved Report, having reference to the experience of two or more preceding seasons, on the effects which any substances, such as those above named, have produced on the soil for a certain period after their application. In all cases, the subsequent produce of the land which received the particular manure, must be noted carefully by weight or measure, and compared with that of an equal portion of land immediately adjoining, which had received no special manure.

Reports to be lodged by 1st November 1856.

7. MANURES FOR PEAT MOSS.

For an approved Report on the best and most economical me-

thod of reclaiming and rendering productive what is generally termed Flow Moss,—and on the substances best adapted for fertilizing it—The Gold Medal, or Ten Sovereigns.

As it is frequently difficult to cart Farm-Yard Manure on Flow Moss for some time after it has been drained, attention is particularly directed to the *portable* manures most efficacious in overcoming the inert properties of peat and rendering it productive. The depth and composition of the Moss experimented on; the method of improvement adopted; the quantity of lime applied, and its effects; the nature of the Drainage; the detailed expenditure, and the results obtained—must be stated.

Reports to be lodged by 1st November 1856.

8. MANURES PRODUCED BY DIFFERENT KINDS OF FEEDING.

For an approved Report of the result of experiments for ascertaining the comparative value of Farm-Yard Manure, obtained from cattle fed upon different varieties of food, by the application of such manures to farm-crops—Twenty Sovereigns.

The Report must state the effects produced on two successive Crops by the application of manures obtained from cattle fed on different sorts of food, such as turnips and straw alone; turnips and straw, with an addition of oil-cake, flax-seed, bean-meal, grain, or other substances. The animals should be as nearly as possible of the same age, weight, condition, and maturity, and each lot should receive daily the same quantity of litter; and, except as to the difference of food, they should be treated in every respect alike.

The preparation of the Manure by fermentation or otherwise, should be in every respect the same; and it is desirable that not less than two several Experiments be made with each kind, and that the ground to which it is to be applied be as equal as possible in quality, and treated in every respect alike.

Reports to be lodged by 1st May in any year.

9. MANURE MADE WITH AND WITHOUT COVER.

For an approved Report on the comparative value of Manure made in the ordinary manner, and of Manure kept under cover till applied to the land—Twenty Sovereigns.

The experiment may either be conducted with Manure made in the open straw-yard, contrasted with that made in covered hammels

or boxes, or conducted with Manure made in feeding-houses, part of which shall have been placed under cover, and part removed to the open dung-pit, and which shall be kept carefully unmixed with any other Manure. Preference will be given to experiments embracing both of these modes. The Cattle must be fed and littered alike. There must be at least an acre of land experimented on with each sort of Manure—the different lots must be manured to the same extent, and be of equal quality of soil, and on two separate portions of each, not less than 20 poles; the crops must be accurately measured. The result, as given by two successive crops, to be reported.

Reports to be lodged by 1st May in any year.

10. MANURE HEAPS.

For an approved Report on the general chemical principles which should regulate the operations of the practical farmer in the making of farm-yard dung—The Gold Medal, or Ten Sovereigns.

The following points should be considered in the Report:—The injurious action of the atmospheric elements; the advantage of regular spreading; the effect of mixing with earthy or vegetable substances; the advantages of slight or firm treading; and the most judicious means of, in ordinary circumstances, conserving the liquid drainings.

While the subject must be treated in its theoretical aspects, and the fertilizing variations in excrements, with the reasons for them, must be described, the practical operations necessary to insure Manure of superior quality, must be detailed.

Reports to be lodged by 1st November 1856.

11. COMPOST HEAPS.

For an approved Report on the management and application of Compost Heaps—The Gold Medal, or Ten Sovereigns.

The Report must state the substances employed; the length of time they have been compounded; the crops to which they have been applied; the nature of the land, and its previous management, and the results of the application. The attention of Competitors is directed not only to the use of substances which may be found on the farm itself, as vegetable refuse, peat and coal ashes, the mud of ponds and ditches, the scraping of roads, &c., but to such foreign substances as they may have been able to mix with the matter of the heaps, and which have been found to add to their

quality and usefulness, such as the offal of shambles and fishing-stations, the refuse-matter of manufactories, and any other substances which can be rendered available as manures.

Reports to be lodged by 1st November 1856.

12. SHELL AND CORAL SAND.

For an approved Report on the application of Shell or of Coral Sand as a fertilizer—The Gold Medal, or Ten Sovereigns.

The Report must state the quantity of Shell or Coral Sand available in a district, its composition, the mode of applying it, the expense of the application, and the results obtained, as compared with those of an experiment with the same crop in similar land without the application. The price at which the sand can be purchased, and the facilities for exporting it, to be stated.

Competitors to send samples of the sand experimented with to Dr Anderson.

Reports to be lodged by 1st November 1856.

13. TOP-DRESSING FOR PASTURE.

For an approved Report on the substances which may be most profitably employed in Top-dressing Pasture—The Gold Medal, or Ten Sovereigns.

The Report must state the nature of the substances used, the time and cost of the application, and the comparative results, which must also be contrasted with those obtained from a portion of the same field to which no top-dressing was applied.

The substances recommended for trial are guano, nitrate of soda, sulphate of ammonia, superphosphate of lime, sulphate of potash, and muriate of potash, but competitors are not restricted to these or any other substances.

Reports to be lodged by 1st November 1856.

14. AUTUMN MANURING.

For an approved Report on the comparative advantages of applying Manure to the Stubble in Autumn, or in the drills in Spring, for Turnips, Potatoes, or Beans—Twenty Sovereigns.

The experiment must extend over three years, and comprise, 1st.

The green crop; 2d. The grain crop; 3d. The clover crop. It must be conducted on not less than four acres—one half of which shall be dunged in autumn, and the other in spring, with equal weights of manure, made as nearly as possible in the same way, and from animals fed on substances of equivalent nutritive values. The quantities and kinds of special manures applied at any period of the rotation must be the same on each lot, and must be stated. The treatment and condition of the land prior to the experiment must be mentioned.

As the object of this premium is to determine the advantages, if any, of autumn manuring, there will be no restriction as to labouring the land, but the Reporter must state how that was done on each lot during the experiment.

Reports to be lodged by 1st November 1858.

15. MANURES FOR GREEN CROPS.

For an approved Report of experiments for determining the kinds and quantities of manures calculated, irrespective of expense, to raise the largest and soundest green crop—whether Turnip or Potato—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1857.

16. IMPROVED VARIETIES OF AGRICULTURAL PLANTS.

For an approved Report on the means successfully employed for obtaining new and superior varieties, or improved sub-varieties, of any of the Cereal Grains, Grasses, Roots, or other Agricultural Plants—The Gold Medal, or Ten Sovereigns.

It is necessary that the varieties and sub-varieties reported upon shall have been proved capable of reproduction from seed, and also that the relation they bear to others, or well-known sorts, should be stated. The Reporter is further requested to mention the effects that he may have observed produced by different soils, manures, &c., on the plants forming the subjects of reports, and how far he may have ascertained such effects to be lasting.

Should any improved variety reported upon be the result of direct experiment by cross impregnation, involving expense and long-continued attention, a higher premium will be awarded.

Reports to be lodged by 1st November 1856.

17. COMPARATIVE PRODUCTIVENESS, &c., OF POTATOES.

For an approved Report on the comparative productiveness, and general qualities for use and keeping, of the different kinds of potatoes used in field culture—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1857.

18. COMPARATIVE PRODUCTIVENESS, &c., OF TURNIPS.

For an approved Report of the comparative productiveness, keeping, and other qualities of the different kinds of Swedish, Yellow, and White Turnips, generally used in field culture—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1857.

19. MANGOLD-WURZEL.

For an approved Report on the cultivation of Mangold-Wurzel in Scotland—The Gold Medal, or Ten Sovereigns.

The Reporter must state the nature and previous preparation of the soil—the varieties grown—the period of sowing—the quantity of seed per acre, and mode of sowing—the time and mode of thinning and cleaning—the best means of preventing seeding—the time and manner of storing—the crop obtained—and its comparative value for feeding purposes.

Reports to be lodged by 1st May 1857.

20. CABBAGE.

For an approved Report on the cultivation of the Cabbage, and its comparative value for feeding purposes—The Gold Medal, or Ten Sovereigns.

The experiment must be conducted on not less than one acre, and contrasted with a like extent under turnips in the same field. Both lots must have been under one rotation, and must be prepared and manured in the same manner.

Reports to be lodged by 1st May 1857.

21. DISEASE IN TURNIPS.

For an approved Report on Finger and Toe in Turnips, detailing the symptoms and progress of the Disease, the supposed predisposing causes, and the means of prevention which have been found most efficacious—The Gold Medal, or Ten Sovereigns.

Attention is directed to Dr Anderson's Report published in the Transactions, October 1853.

Reports to be lodged by 1st May 1857.

22. RED CLOVER.

For an approved Report, founded on actual experiment, on the success attending the cultivation of Red Clover, by sowing it at different periods—The Gold Medal, or Ten Sovereigns.

The Clover seed must be sown at three distinct times from the beginning or middle of February to the middle of May. The quantities of the seed sown to be always at the same rate per acre, and the treatment to be uniform. It will add to the value of the paper if the Reporter can state the effects of greater or smaller quantities of seed, and also, whether the ordinary mixture of Ryegrass, and White and Yellow Clover, or either of them, is prejudicial or otherwise to the growth of the Red Clover. The object of the premium being, if possible, to ascertain how the Red Clover plant may be cultivated with the greatest chance of success, the Reporter's views on the subject should be fully stated.

Reports to be lodged by 1st November 1857.

23. ITALIAN RYEGRASS.

For an approved Report, founded upon actual experiments, on the most successful and economical cultivation of Italian Ryegrass—The Gold Medal, or Ten Sovereigns.

The Reporter must state what kind has been found most profitable, whether foreign or home-grown; how many years it may be allowed to stand with advantage; when it is necessary again to plough up the land and sow it afresh with Italian Ryegrass; and how that can be best done in the shortest possible period.

Reports to be lodged by 1st November 1856.

24. VEGETABLE PRODUCTIONS OF INDIA, CHINA, AMERICA, ETC.

For an approved Report on the Hardy and useful Herbaceous Plants, including Grains and Grasses of China, Japan, the Islands of the Eastern Archipelago, the Himalaya Country, the Falkland and South Sea Islands, California, the high north-western districts of America, or any other country where such climate exists as to induce the belief that the plants may be beneficially introduced into the cultivation of Scotland—The Gold Medal, or Ten Sovereigns.

Reporters are required to give the generic and specific names of the plants treated of, with the authority for the same—together with the native names, in so far as known; and to state the elevation of the locality and nature of the soil in which they are cultivated, or which they naturally inhabit, with their qualities or uses; and it is further requested that the descriptions be accompanied, in so far as possible, with specimens of the plants, and their fruit, seed, or other products.

Reports to be lodged by 1st November in any year.

FEEDING STOCK.

In the following experiments, the animals selected should be of the same age, sex, and breed, and, as nearly as possible, of the same weight, condition, and maturity. Their live weight before and after the experiment must be stated, and, if killed, their dead weight, and quantity of tallow.

25. BEST MODES OF HOUSING FATTENING CATTLE.

For an approved Report on the comparative advantages of fattening Cattle in stalls, in loose houses or boxes, and in sheds or hammels—Twenty Sovereigns.

The Report must detail the comparative result of actual experiments. The same quantities and kinds of food shall be used. Information is required as to the comparative expense of attendance, the cost of erecting the buildings, and any other circumstances deserving of attention. The state of the weather during the experiment in point of temperature and wetness must be particularly noted and reported.

Reports to be lodged by 1st May 1857.

26. SOILING AND PASTURING CATTLE.

For an approved Report, founded on experiment, on the comparative advantages of soiling and pasturing Cattle—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1857.

27. DIFFERENT DESCRIPTIONS OF FOOD.

For an approved Report of experiments for ascertaining the actual addition of weight to growing or fattening stock, by the use of different kinds of food—Twenty Sovereigns.

The attention of the experimenter is directed to Turnips, Carrots, Beet, Mangold-Wurzel, Potatoes, Cabbage, as well as to Beans, Oats, Barley, Indian Corn, Flax-Seed, Oil-Cake, or Rape-Cake, and to the effect of warmth and proper ventilation, and the difference between food cooked and raw. The above roots and other kinds of food are merely suggested; Competitors are neither restricted to them, nor obliged to experiment on all of them.

When experiments are made with Linseed and Oil Cake, it is requested that attention be paid to the comparative advantages, economically and otherwise, of the substances in these two states.

Before commencing the comparative experiments, the animals must be fed equally for some time previously.

The progress of different breeds may be compared; this will form an interesting experiment of itself, for Reports of which encouragement will be given.

Reports to be lodged by 1st May 1857.

28. COMPARATIVE QUALITIES OF HAY AND STRAW AS FOOD.

For an approved Report of the result of experiments for ascertaining the comparative value of Hay and Straw when employed for feeding Cattle—The Gold Medal, or Ten Sovereigns.

The Hay and Straw must have been supplied to the Cattle under the same circumstances. The value of the experiment will be enhanced if it includes Hay of both first and second cuttings.

Reports to be lodged by 1st May 1857.

29. COMPARATIVE QUALITIES OF CAKE AND HAY FOR SHEEP.

For an approved Report on the comparative improvement and

increase of weight, during a period of not less than four months, of three lots of five sheep each, fed as follows,—five on Turnips and Oil-Cake, five on Turnips and Rape-Cake, and five on Turnips and Hay—The Gold Medal, or Ten Sovereigns.

The experiment must be so conducted and reported as satisfactorily to establish whether Oil-Cake, Rape, or Hay is the most profitable auxiliary.

Reports to be lodged by 1st May 1857.

30. PULPED TURNIPS FOR CATTLE.

For an approved Report of the result of experiments for determining the comparative feeding value of Pulped Turnips mixed with cut Straw, and of whole or sliced Turnips with Straw, either cut or uncut—Twenty Sovereigns.

The straw with the pulped turnips must be cut, but with the whole, or sliced, it may be either cut or in hecks—and the experiment would be enhanced if it embraced it in both states. The experiment must be made with cattle in all respects as nearly alike as possible, and not fewer than three in each lot, and it must extend over a period of not less than three months. The mode of pulping, and the comparative cost of that process and of slicing, and the expense generally of preparing the food, must be stated; and when oil-cake, rape, or any other substance is added, the quantities must be the same to each lot, and must be stated in the Report.

Reports to be lodged by 1st May 1857.

31. PULPED TURNIPS FOR PIGS.

For an approved Report of experiments for determining the comparative feeding value of Pulped Turnips mixed with Meal, and of the steamed food ordinarily given to pigs—The Gold Medal, or Ten Sovereigns.

The Reporter will, in as far as possible, attend to the conditions attached to the last Premium.

Reports to be lodged by 1st May 1857.

32. FEEDING SHEEP IN THE FIELD OR UNDER COVER.

For an approved Report on the comparative advantages of feeding Sheep in the open field, and in covered pens or boxes. The experiment to be made with at least two lots of five Sheep, fed alike

on Turnips and any other auxiliary for not less than four months—The Gold Medal, or Ten Sovereigns.

The Report must embrace all economical elements tending to establish which is the most profitable mode of feeding.

Reports to be lodged by 1st May 1857.

33. DISEASES OF SHEEP FED ON TURNIPS.

For an approved Report on the nature, symptoms, causes, preventive and remedial treatment, and *post-mortem* appearances, of the Diseases to which Sheep are subject when fed on Turnips, and on the conditions of soil and management under which such diseases are most apt to manifest themselves. The popular as well as the scientific names of diseases to be made use of—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1857.

34. BRAXY IN SHEEP.

For an approved Report on the nature, symptoms, causes, preventive and remedial treatment, and *post-mortem* appearances, of Braxy in Sheep. The popular as well as the scientific names of diseases to be made use of—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1856.

35. DISEASES OF SWINE.

For an approved Report on the nature, symptoms, causes, preventive and remedial treatment, and *post-mortem* appearances, of the Diseases incidental to Swine. The popular as well as the scientific names of diseases to be made use of—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1856.

36. RURAL ECONOMY ABROAD.

For an approved Report, founded on personal observation, of any useful practice in Rural or Domestic Economy, adopted in other countries, and susceptible of being introduced with advantage into Scotland—The Gold Medal.

The purpose chiefly contemplated by the offer of this premium is to induce gentlemen who may visit other countries to notice and re-

cord such particular practices as may seem calculated to benefit their own country.

Reports to be lodged by 1st November in any year.

SECTION 2. WOODS AND PLANTATIONS.

1. EXTENSIVE PLANTING.

For an approved Report by a Proprietor who shall, within the five preceding years, have planted the greatest extent of ground, not being less than 150 acres. The whole planting operations that may have been conducted by the Reporter within the five years, whether completed or not, must be embraced, and he must state the expense—description of soil—age, kind, and number of trees planted per acre—mode of planting, draining, and fencing—and general state of the plantation—and any other observations of interest—The Gold Medal.

Reports to be lodged by 1st November in any year.

2. FORMATION AND MANAGEMENT OF YOUNG PLANTATIONS.

For an approved Report of Plantations formed within a period of not more than ten, nor less than five years preceding the date of the Report—The Gold Medal, or Ten Sovereigns.

The Report should comprehend every interesting particular; among others, the exposure, altitude, and general climate of the locality; the previous character and condition of the soil and subsoil; a detailed statement of the expense, including that of inclosing, draining, and fencing, and a specification of the manner in which these operations were performed—the mode of planting adopted—the prevailing weather while planting, and for a month after the operation—the kind of trees planted, and the number of each kind per acre—their relative progress—the proportion of blanks and deaths at the end of three years—the system of management—the state of the plantations at the date of making the Report—and any other observation of interest.

Reports to be lodged by 1st November in any year.

3. GENERAL MANAGEMENT OF PLANTATIONS.

For an approved Report on the Management of Plantations, from

the commencement of the first thinning till the period of yielding full-grown timber—The Gold Medal, or Ten Sovereigns.

The Report should embrace the following points:—The annual progress of the different sorts of trees—the effects of altitude and exposure—the general advantages of shelter—the mode of thinning and pruning adopted—the uses and value of the thinnings—the plan of registry and of valuing, or a specimen of the method in which the forester's book is kept—the valuation at the time of the Report—together with such general remarks as may be thought useful.

The Report is not expected to embrace the formation and early management, further than the description of soil, kinds of plants, whether mixed or in masses, together with a note of the expense from the time of planting to the commencement of the first thinning, in so far as such information is in the possession of the Reporter.

Reports to be lodged by 1st November in any year.

4. USES AND VALUE OF TIMBER.

For an approved Report, on the economic uses and comparative value of different descriptions of Timber grown in Scotland—The Gold Medal, or Ten Sovereigns.

This premium may be regarded as a sequence to Nos. 2 and 3; the object being to obtain the practical and economic results of forming and of managing woods, by ascertaining the purposes to which they have been applied, and the pecuniary returns they have yielded.

The Reporter, besides stating the actual results of his own observation and experience, should indicate the objects which planters ought to have in view with reference to profitable return, by stating the kinds of trees that should be planted, the periods at which they should be cut, the purposes to which they should be applied, and the returns that may be looked for in different localities, and under different circumstances.

There must be a general description of the management, soil, altitude, exposure, &c. of the particular woods reported on, and attention is directed to the difference supposed to exist in the quality of natural and planted timber.

Reports to be lodged by 1st November in any year.

5. COMPARATIVE QUALITIES OF SCOTCH, AUSTRIAN, AND CORSICAN FIR.

For an approved Report on the comparative value, for economical purposes, of the Scotch, Austrian, and Corsican Fir, and on their adaptation to different soils and situations—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November in any year.

6. PLANTING WITHIN THE INFLUENCE OF THE SEA, OR ON BARREN TRACTS.

For an approved Report on successful Planting within the influence of the sea, or on exposed sterile tracts, founded on observation of the habits and appearance of the different sort of trees considered best suited for such situations—The Gold Medal, or Ten Sovereigns.

The plantations reported on must be not less than ten years old.

Information is particularly desired regarding the species and varieties of trees calculated for growing in situations unfavourable to most of those generally cultivated, as bleak heaths, sandy links, exposed maritime situations, and high northern exposures.

The Reporter must specify the extent of planting and mode of drainage and fencing—the nature of the soil and subsoil—the elevation and exposure of the locality—and its distance from the sea; and, if in his power, he should notice the underlying rocks, and the geological features of the district.

Reports to be lodged by 1st November in any year.

7. ARBORETUM.

For an approved Report on the most varied, extensive, and judiciously arranged collection of hardy, or supposed hardy, forest and ornamental Trees, either *species* or marked *varieties*, of not less than five years' standing, and in Scotland—The Gold Medal, or Ten Sovereigns.

The Arboretum must be formed so as to afford ample space for the full development of the specimens. The Report must specify the nature of the locality—its altitude and exposure—the description

and previous preparation of the soil—the date of planting—the system of draining—fencing—and pruning—and any other circumstances which may be supposed to influence the growth of the plants; the number of failures, with the periods when, and circumstances under which, these occurred, must also be reported. Information should be added, when in the Reporter's possession, as to the age and average height of the specimens—whether they are seedlings, cuttings, layers, or grafted plants—and, if possible, the stock on which they have been grafted.

The Report must be accompanied with a correct list, containing the names of the different species and varieties, with an authority for each, and a plan showing the disposition of each specimen. The trees in the Arboretum must be numbered and named relative to the list and plan.

Reports to be lodged by 1st November in any year.

8. DISEASES OF FOREST TREES.

For an approved Report on the diseases incidental to Forest Trees, and the injuries they sustain from the attacks of Insects—The Gold Medal, or Ten Sovereigns.

The Report must state the kinds of Trees most generally liable to attack—the parts first affected—the age of the Tree and period of the season when first observed—the state of the drainage—the altitude and exposure of the locality, and its geological formation—the nature of the soil and subsoil—when and how the Trees were pruned—the remedies, preventive and remedial, which may have been tried. Information is required as to the causes of decay—whether attacks of insects, or cryptogamic growth—and how far either of these causes may have been induced by the previous sickly or stunted condition of the Tree. Attention is directed to the Beech, Larch, Silver Fir, and White Pine (*Pinus Strobus*), and to the Coniferæ generally, and particularly to the stripping of the leaves from Scotch and other Pines by the pine-leaf caterpillar.

Reports to be lodged by 1st November in any year.

9. PLANTING ON PEAT MOSS.

For an approved Report on Plantations, of not less than eight years' standing, formed on deep peat moss—The Gold Medal, or Ten Sovereigns.

It being understood that large tracts of peat moss have been profit-

ably planted in England and Holland, it is considered desirable to obtain information on the subject. The Premium is strictly applicable to deep peat or flow moss; the condition of the moss in its original state, as well as at the date of the Report, should, if possible, be stated.

The Report must describe the mode and extent of the drainage, and the effect it has had in subsiding the moss—the trenching, levelling, or other preliminary operations that may have been performed on the surface—the mode of planting—kinds, sizes, and number of trees planted per acre—and their relative progress and value, as compared with plantations of a similar age and description, grown on other soils in the vicinity.

Reports to be lodged by 1st November in any year.

10. WILLOWS.

For an approved Report on the cultivation of Willows, and their most advantageous employment for basket and other industrial purposes—The Medium Gold Medal, or Five Sovereigns.

The Report must state the nature of the soil and subsoil—the time and mode of planting—the expense per acre—the best varieties—and the most profitable applications.

Reports to be lodged by 1st November 1856.

11. FOREST TREES OF RECENT INTRODUCTION.

For an approved Report on the more extended introduction of hardy useful or ornamental Trees, which have not hitherto been generally cultivated in Scotland—The Gold Medal.

The Report should specify, as distinctly as possible, the kind of trees introduced. The nature of the plantation should likewise be described, as to soil, exposure, shelter, and elevation above the level of the sea. The adaptation of the Trees for use or ornament, and their comparative progress, should be mentioned. Attention is directed to the introduction into use of any tree as a nurse in young plantations, which, by growing rapidly for several years, and attaining maturity when at the height of 20 or 25 feet, might realize the advantages and avoid the evils of thick planting.

Reports to be lodged by 1st November in any year.

12. IMPORTATION OF SEEDS.

To the person who shall send to the Society seeds capable of

germination, either of new or recently-introduced Coniferæ, or of the rarer kinds of forest trees—The Medium Gold Medal.

Before the Premium is awarded, the number of seedling Plants of each species raised by the Society shall not have been less than 50. Seeds of Coniferæ may be sent home in the cones, wrapped in brown paper, packed in a box, to be kept in a cool, airy part of the cabin, but on no account in the hold, nor in close tin cases. Hasty and severe heating in extracting seeds from the cone should be carefully avoided. Seeds of Hardwood may be packed in brown paper, or in sphagnum (moss), or they may be mixed with soil and placed in strong boxes.

Seeds may be forwarded at any time.

As some of the experiments suggested in the foregoing section require to be conducted for several years before definite results regarding every particular can be arrived at, occasional communications, detailing facts of importance, will be received and acknowledged by honorary rewards.

SECTION 3. WASTE LANDS.

1. IMPROVEMENT OF WASTE LAND BY TILLAGE.

1. For an approved Report by a Proprietor or Tenant of the improvement, within the six preceding years, of not less than fifty acres of Waste Land—The Gold Medal, or Ten Sovereigns.

2. For an approved Report by a Tenant of the improvement, within the four preceding years, of not less than twenty acres of Waste Land—The Medium Gold Medal, or Five Sovereigns.

3. For a similar Report by a Tenant of the improvement of not less than ten acres—The Silver Medal.

The Report may comprehend such general observations on the Improvement of Waste Lands, as the writer's experience may lead him to make, but must refer especially to the land reclaimed—to the nature of the soil—the previous state and probable value of the subject—the obstacles opposed to its improvement—the mode of management adopted—and the produce and value of the crops produced. As the required extent cannot consist of different patches of land, the improvement must have relation to one subject, it must be of a profitable character, and two crops at least must have been secured before the date of the Report. *A detailed*

statement of the expenditure and return, and a certified measurement of the ground, are requisite.

Reports to be lodged by 1st May in any year.

2. IMPROVEMENT OF WASTE LAND WITHOUT TILLAGE.

1. For an approved Report of the improvement, within the three preceding years, of the pasturage of not less than thirty acres, by means of Top-Dressing, Draining, or otherwise without tillage, in situations where tillage may be inexpedient—The Gold Medal, or Ten Sovereigns.

2. For an approved Report of a similar improvement of not less than ten acres—The Silver Medal.

Reports must state the particular mode of management adopted, the elevation and nature of the soil, its previous natural products, and the changes produced.

Reports to be lodged by 1st May in any year.

SECTION 4. AGRICULTURAL MACHINERY.

1. INVENTION OR IMPROVEMENT OF IMPLEMENTS OF HUSBANDRY.

For approved Reports of such inventions or improvements, by the Reporters, of any Agricultural Implement or Machine as shall be deemed by the Society of public utility—Medals or Sums not exceeding, in all, Fifty Sovereigns.

Reports may be lodged with the Secretary at any time, and should be accompanied by drawings and descriptions of the implement or machine, and, if necessary, by a model.

2. BEST CONSTRUCTION OF PLOUGH.

For an approved Report on different descriptions of Ploughs for different purposes—The Gold Medal, or Ten Sovereigns.

The attention of Competitors is particularly called to the importance of obtaining increase of depth with the least possible increase of draught. The Reporter should consider the merits of Swing Ploughs, as compared with English Wheel Ploughs; and the comparative advantages of the Scotch Ploughs, which give a high crested shoulder, and which give a rectangular shoulder. The

best description of Subsoil and Trench Ploughs should also be adverted to.

Reports to be lodged by 1st November 1856.

3. BEST CONSTRUCTION OF HARROWS.

For an approved Report on the best construction of Harrows for different soils, calculated to produce, at regulated depths, the greatest division of the soil, with the least expenditure of power—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1856.

4. THRASHING MACHINES.

For an approved Report and description of an improved Thrashing Machine, in all its details. The Report must be accompanied with Drawings of the arrangements—Twenty Sovereigns.

Reports to be lodged by 1st November 1856.

5. SCOTCH AND ENGLISH THRASHING MACHINES.

For an approved Report on the comparative merits of the best Scotch and the best English Machines with high speed drums—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1856.

6. WINNOWING MACHINE.

For an approved Report of any useful Improvements on the Winnowing Machine, more particularly such as tend to increase the efficiency of the Fan, and reduce the dimensions of the Machine, without detracting from its efficiency—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1856.

7. SUBSTITUTE FOR WINNOWING MACHINE.

For an approved Report of any useful Machine qualified to dress grain more effectually than the Winnowing Machine now in use—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1856.

8. POTATO LIFTER.

For an approved Report and description of an Implement calculated to lift Potatoes more expeditiously and economically than the Graip, and more efficiently than the Common Plough—The Medium Gold Medal, or Five Sovereigns.

Reports to be lodged by 1st November 1856.

9. WHIN BRUISER, WITH ATTACHMENT.

For an approved Report of a Machine qualified to bruise, and to cut Furze or Whins, and capable of attachment to the Thrashing Machine, or other motive power of the farm—The Medium Gold Medal, or Five Sovereigns.

Reports to be lodged by 1st November 1856.

10. REAPING MACHINES.

For the Reaping Machine which, upon trial, shall be found superior in efficiency, economy, and simplicity to any of the Reapers now before the public—Fifty Sovereigns.

Intimation of intention to compete for this premium must be made to the Secretary not later than the 1st of July, and must be accompanied by the name of the Exhibitor, a description of the machine, and a statement of its price. Exhibitors will be bound to send their machines, free of cost to the Society, to any place within twenty miles of Edinburgh or Glasgow that may be selected for the trial, and will be subject to such rules and conditions as may be laid down by the directors for the competition.

CLASS II.

LIVE STOCK—DISTRICT COMPETITIONS.

SECTION 1. CATTLE.

DISTRICTS.

1. *The Island of Lews, including the District of Harris.*
2. *The Stewartry of Kirkcudbright.*
3. *The Middle Ward of Lanarkshire to the South of the Clyde, and the Parish of Lesmahago.*

4. *The District in connexion with the Inverness Farmers' Club.*
5. *The Districts of Ythanside and Formartine.*
6. *The County of Kincardine.*
7. *The District in connexion with the Garioch Farmers' Club.*
8. *The District of Strathspey.*
9. *The Islands of Orkney.*

CLASS I.

1. For the best Bull, of any pure Breed, not exceeding eight years old, belonging to a Proprietor or Factor—The Silver Medal.

2. For the Best Bull, of any pure Breed, calved before 1st January 1854, and not exceeding eight years old, belonging to a Tenant or Proprietor farming the whole of his own lands—Eight Sovereigns.

3. For the second best—Four Sovereigns.

4. For the best Bull of any pure Breed, calved after 1st January 1854, belonging to a Tenant or Proprietor farming the whole of his own lands—Five Sovereigns.

CLASS II.

1. For the best pair of Heifers, of any pure Breed, of two years old (if Highland Breed, three years), belonging to a Tenant or a Proprietor farming the whole of his own lands—Five Sovereigns.

2. For the second best—Three Sovereigns.

The Society's Premiums are granted to each District for three alternate years, on condition that the Districts shall, in the two intermediate years, continue the Competitions by offering a sum not less than one-half of that given by the Society.

In 1856,

No. 1 is in competition for the second year.
Nos. 2 and 3 for the first year.

No. 4 is in abeyance on account of the Inverness Show.
Nos. 5, 6, 7, 8, and 9, compete for local premiums.

Conveners of Committees.

FOR THE FIRST DISTRICT—Sir James Matheson of Lews, Bart., M.P.

For the Second District—Wellwood Maxwell of Munshes.
For the Third District—Pat. Graham Barns of Limekilns.
For the Fourth District—Henry W. White of Monar.
For the Fifth District—John Leith Ross of Arnage.
For the Sixth District—Sir John S. Forbes, Bart.
For the Seventh District—Sir James Dalrymple Elphinstone, Bart.
For the Eighth District—Cluny Macpherson.
For the Ninth District—Robert Scarth of Binscarth.

RULES OF COMPETITION.

1. The Members of the Society connected with the respective Districts are appointed Committees of superintendence for regulating the Competitions; three Members to be a quorum.

2. The Convener of each District will summon a meeting of Committee, for the purpose of determining the time and place of Competition, the nomination of Judges, and other preliminary arrangements. The time and place will be publicly intimated by Conveners, in such a manner as may appear to them most effectual.

3. The Competitions must take place between the 1st of June and the 1st of October. The animals exhibited must belong to one of the pure Breeds—Short-horn—Ayrshire—Polled (Galloway, Angus, or Aberdeen)—Highland. The Bull may be of one Breed, and the Heifers of another. The Committee will select the Breed, and specify it in the returns.

4. Stock of an inferior description, or which does not fall within the prescribed regulations, shall not be placed for Competition. The Premiums shall not be divided. No Money Premium shall be adjudged unless there are three Lots exhibited, and not more than one-half unless there are six. A Competitor may exhibit two Lots in each Class. For the Medal, two Lots authorise an award.

5. An animal which has gained the Society's first Premium at a previous District or General Show, is inadmissible, except for the Medal; and one which has gained a Second Money Premium can only thereafter compete for the First. The same animal cannot be entered for the Medal and the Money.

6. A Tenant may compete with Proprietors and Factors for the Medal with a Bull which has gained the first Money Premium at a previous show. When there is any doubt as to whether a Competitor should be ranked as a Proprietor or a Tenant, the point is left to the decision of the Local Committee. Factors can only compete for the Medal.

7. A Bull, the property of two or more Tenants, may compete, although the Exhibitors may not be joint Tenants. Bulls not belonging to the District may compete, provided they are left within it for service.

8. Bulls for which the Money Premiums are awarded must serve in the District at least one season; and the rate of service may be fixed by the Committee.

9. Blank Reports and Returns will be furnished to the Conveners of the different Districts. These must, in all details, be completed and lodged with the Secretary on or before the 15th of October next.

10. It is to be distinctly understood, that in no instance does any claim lie

against the Society for expenses attending a Show of Stock, beyond the amount of the Premiums offered; and that all Premiums not applied for within two years from the term of payment (10th February 1857) shall be forfeited.

11. A Report of the Competition and Premiums awarded at the *intermediate* Local Shows, in the several Districts, signed by a member of the Society, must be transmitted to the Secretary on or before the 15th of October in each year, otherwise, the Society's grant shall terminate.

SECTION 2. DRAUGHT HORSES.

DISTRICTS.

1. *The District in connexion with the Strathendrick Farmers' Society.*

CONVENER—John Buchanan of Carbeth.

2. *The District in connexion with the Forfarshire Agricultural Society.*

CONVENERS—Lord Panmure, and Sir John Ogilvy, Bart.

3. *The District in connexion with the Lauder Agricultural Society.*

CONVENER—The Hon. Sir Anthony Maitland.

Forty Sovereigns, of which twenty are contributed by the Local Associations, will be awarded as follows:—

1. For the best Stallion, for agricultural purposes, not under three years and nine months, and not above twelve years old—Twenty-five Sovereigns.

2. For the best Brood Mare, for agricultural purposes—Ten Sovereigns.

3. For the best Filly, foaled after 1st January 1854—Five Sovereigns.

RULES OF COMPETITION.

1. The Members of the Society in the District are appointed a Committee of Superintendence, as in No. 1 of the Regulations for the Cattle Competitions; and they will be convened in the same manner, and for purposes similar to those indicated in the said Regulations.

2. The time and place of Competition for the respective Districts will be fixed by the Convener, with the concurrence of the Committee, and published by him in due time, and in such manner as shall be thought most effectual for the information of those interested.

3. If fewer than three animals be exhibited in any class, half the Premium only can be awarded. The Regulations for Cattle Shows, regarding previous

intimation to the Committee and Competitors—the power of the Committee to exclude stock, if of inferior character—extra expenses—the period within which Premiums must be applied for—and the manner in which the Reports are to be certified and transmitted to the society—are severally applicable to the Premiums for Horses. Evidence must be produced that the Prize Stallions have had produce. Mares must have foals at their feet, or be entered as being in foal; in the latter case, payment of the Premium will be deferred till certificate of birth.

ENTIRE COLTS.

NOTE.—The Society being anxious to promote the improvement of Draught Horses by encouraging the rearing of entire Colts, Stallion premiums are limited to a period of two years, and followed by premiums for other two years within the same District for entire Colts.

DISTRICTS.

1. *The District in connexion with the Glasgow Agricultural Society.*

CONVENER—Mark Sprot of Garnkirk.

2. *The District of Mid-Calder, with the Parishes of Livingston, Uphall, and Kirkliston, in Linlithgowshire.*

CONVENER—Sir A. C. Gibson Maitland, Bart.

1. For the best entire Colt, for agricultural purposes, foaled after 1st January 1854—Six Sovereigns.

2. For the best entire Colt, for agricultural purposes, foaled after 1st January 1855—Four Sovereigns.

If fewer than three animals are exhibited in either class, only half the Premium can be awarded. The other regulations are generally applicable.

SECTION 3. SHEEP.

1. LEICESTER BREED.

DISTRICTS.

1. *The Counties of Edinburgh and Haddington.*
2. *The County of Ayr.*
3. *The County of Banff, and Turriff District.*

4. *The District in connexion with the Border and Union Agricultural Society.*
5. *The District of Easter Ross.*

1. For the best Tup of any age, belonging to a Proprietor, or Factor—The Silver Medal.
2. For the best Tup of any age—Five Sovereigns.
3. For the best two Shearling Tups—Five Sovereigns.
4. For the best Pen of five Ewes, not less than two Shear—Five Sovereigns.
5. For the best Pen of five Gimmers or Shearling Ewes—Four Sovereigns.

The Money Premiums are restricted to Tenants, and Proprietors farming the whole of their own Lands.

In 1856—

No. 1 is in competition for the last year.
No. 2 for the first year.

Nos. 3, 4, and 5 compete for Local Premiums.

Conveners of Committees.

FOR THE FIRST DISTRICT—James Aitchison of Alderston.
FOR THE SECOND DISTRICT—James Campbell of Craigie.
FOR THE THIRD DISTRICT—Alex. Morison of Bognie.
FOR THE FOURTH DISTRICT—Lord Polwarth.
FOR THE FIFTH DISTRICT—Wm. H. Murray of Geanies.

2. CHEVIOT BREED.

DISTRICTS.

1. *That part of Argyllshire attached to the Sheriffship of Tobermory, with the Districts of Kingairloch, Ardgour, and Ardnamurchan.*
2. *The County of Sutherland and the Parishes of Reay and Latheron in Caithness.*
3. *The County of Roxburgh.*
4. *The Island of Skye.*

1. For the best Tup of any age, belonging to a Proprietor or Factor—The Silver Medal.

2. For the best Tup of any age—Five Sovereigns.
3. For the best two Shearling Tups—Five Sovereigns.
4. For the best Pen of five Ewes, not less than Two Shear—Five Sovereigns.
5. For the best Pen of five Gimmers or Shearling Ewes—Four Sovereigns.

The Money Premiums are restricted to Tenants, and Proprietors farming the whole of their own Lands.

In 1856—

No. 1 is in competition for the first year.

No. 2 is in abeyance on account of the Inverness Show.
Nos. 3 and 4 compete for Local Premiums.

Conveners of Committees.

For the First District—William Robertson of Kinlochmoidart.
For the Second District—George Dempster of Skibo.
For the Third District—John Ord of Muirhouselaw.
For the Fourth District—Lord Macdonald, or his Factor.

3. BLACK-FACED BREED.

DISTRICTS.

1. *The District of Cowal.*
2. *The Districts of Currie, Penicuik, and Biggar.*
3. *The District of Breadalbane and Killin.*
4. *The District of Fort-William.*
5. *The County of Wigtown.*

1. For the best Tup of any age, belonging to a Proprietor or Factor—The Silver Medal.
2. For the best Tup of any age—Five Sovereigns.
3. For the best two Shearling Tups—Five Sovereigns.
4. For the best pen of five Ewes, not less than Two Shear—Four Sovereigns.
5. For the best pen of five Gimmers or Shearling Ewes—Four Sovereigns.

The Money Premiums are restricted to Tenants and Proprietors farming the whole of their own Lands.

In 1856—

No. 1 is in competition for the last year.
No. 2 for the second year.
No. 3 for the first year.

No. 4 is in abeyance on account of the Inverness Show.
No. 5 competes for Local Premiums.

Conveners of Committees.

For the First District—Robert Maclachlan of Maclachlan.
For the Second District—Sir George Clerk, Bart.
For the Third District—James F. Wyllie, Bolfracks.
For the Fourth District—Thomas Macdonald, Fort-William.
For the Fifth District—Sir Andrew Agnew, Bart.

RULES OF COMPETITION.

1. The Members of the Society in the several Districts are appointed Committees of Superintendence, as in Nos. 1 and 2 of the Regulations for Cattle Competitions, and they shall be convened by their respective Conveners on or before the 20th of May, in the same manner and for the same purposes as specified in these Regulations.

2. The Competition shall take place between the 1st of June and the 1st of October, and the time and place must be publicly intimated by each Convener within his District.

3. Tups shall have served the usual number of Ewes for at least three weeks during the previous season. All prize Tups must serve within the Districts during the previous season. The Competitions are open to Tups not belonging to the Districts, provided they are left to serve in them. Ewes must have reared Lambs during the season. Ewes and Gimmers must be taken from regular breeding hirsels.

4. The Premiums shall not be divided. No Money Premium shall be adjudged unless there are three Lots exhibited, and only one-half if there are not six Lots. Each Competitor may show two Lots. For the Medal two Lots authorize an award. The other Regulations for Cattle Competitions—in regard to the placing of Stock—the exclusion of Animals which have gained Premiums at previous shows—the right of a Tenant, under certain circumstances, to compete for the Medal—the Regulation as to expenses—the period within which Premiums must be applied for—and the manner in which the Reports must be certified and transmitted—are applicable to the Premiums for Sheep.

5. The Society gives these Premiums in alternate years for three Competitions in each District, if, during the intervening years, Premiums are awarded by the District to an amount not less than one-half of the Society's Premiums, and for the same description of Stock. Reports of these intermediate Competitions must be lodged by the 15th of October, or the Society's grant shall terminate.

6. Blank Reports, and Returns of Competitions, will be furnished to the Conveners of Districts. These must be accurately filled up in all details, signed by the Convener, and transmitted to the Secretary by the 15th of October.

4. SHEARING SHEEP.

The Silver Medal will be given to the best Sheep-shearer in each of the Districts in which the Premiums for sheep are in operation.

CONDITIONS.

1. A guarantee must be lodged with the Secretary by the 20th of May, that Money Premiums will be awarded at each Competition, to the amount of not less than £2.

2. The District Convener will fix the time and place of Competition, and make all necessary arrangements.

3. The Medal shall not be awarded unless there are three Competitors, and it shall always accompany the highest Money Premium; if two or more Lots appear to be equally well executed, preference should be given to that executed within the shortest time.

4. The Conveners shall report the particulars of the Competition and the award of the Judges to the Society, along with the Report of the Sheep Premiums in the District.

SECTION 4. SWINE.

1. *Lower Annandale and Nithsdale.*

CONVENER—Colonel Graham of Mossknow.

2. *The District of Formartine.*

CONVENER—Rear-Admiral the Hon. William Gordon.

1. For the best Boar belonging to a Proprietor or Factor—The Silver Medal.
2. For the best Boar—Four Sovereigns.
3. For the second best—Two Sovereigns.
4. For the best Breeding Sow—Three Sovereigns.
5. For the second best—One Sovereign.

The Money Premiums are restricted to Tenants, and Proprietors farming the whole of their own Lands.

The Regulations for Cattle Competitions, pages 36 and 37, are to be held as applicable to the Premiums for Swine; and the Convener and Committee of the Society's Members in the Districts are accordingly referred to them.

CLASS III.

DAIRY PRODUCE.

DISTRICTS.

1. *The District of Lorn.*

CONVENER—Dugald MacDougall of Gallanach.

2. *The District of Kintyre.*

CONVENER—Smollet Montgomery Eddington of Glencreggan.

3. *The District connected with the Ardrossan Farmer's Club.*

CONVENER—Gavin Fullarton of Kerelaw.

1. BUTTER.

1. For the best sample of cured Butter (not less than 14 lbs.) belonging to a Proprietor or Factor—The Silver Medal.
2. For the best sample of cured Butter (not less than 14 lbs.) belonging to a Tenant, or Proprietor farming the whole of his own lands—Three Sovereigns.
3. For the second best—Two Sovereigns.

2. CHEESE.

1. For the best couple of Sweet Milk Cheeses belonging to a Proprietor or Factor—The Silver Medal.
2. For the best couple of Sweet Milk Cheeses belonging to a Tenant, or Proprietor farming the whole of his own lands—Three Sovereigns.
3. For the second best—Two Sovereigns.

CONDITIONS.

1. The Members of the Society, resident within the Districts, are appointed Committees of superintendence, for the purposes expressed in the Regulations for Cattle competitions.
2. Competitors must certify that the Butter and Cheese exhibited by them are average specimens of the produce of their Dairies in 1856; and that the

quantity produced during the season has not been less than 1 cwt. of butter, or 2 cwt. of cheese. Cheeses may be made either in the Scotch or English mode, provided they be of full milk only, and without any admixture of cream. The Committees shall fix such general regulations as they may consider proper—and, in particular, the time and place of competition. In the event of two or more competing Lots being deemed equal in quality, the Premium will be awarded to the Competitor who shall have made the larger quantity. The successful Competitors, before receiving the Premiums, are required to transmit to the Secretary a detailed Report of the whole process followed by them in the manufacture of their Butter or Cheese.

Reports of the award of the Premiums to be lodged with the Secretary on or before the 1st November 1856.

CLASS IV.

CROPS AND CULTURE.

1. SEEDS.

The Society, with a view of aiding Local Associations in the improvement of the different Grains, Grasses, Roots, &c., offers the Silver Medal to the growers of the best Seeds, for which a Premium of Two Pounds has been awarded in the district.

MEDALS HAVE BEEN GRANTED TO THE FOLLOWING DISTRICTS:—

1. District of KINTYRE: Convener, Smollett Montgomery Eddington of Glencreggan.

   1. Sandy Oats.
   2. Bere.
   3. Mazagan Beans.
   4. Perennial Rye Grass.

2. District of BUCHAN: Convener, James Ferguson of Kinmundy.

   1. Early Berlie Oats.
   2. Perennial Rye Grass.

3. District of WESTER ROSS: Convener, Sir James J. R. Mackenzie, Bart. of Scatwell.

   1. Any variety of White Wheat.
   2. Any variety of Barley.

3. Any variety of Oats.
4. Perennial Rye Grass.

4. County of INVERNESS: Convener, Arthur Forbes of Culloden.

1. Any variety of White Wheat.
2. Any variety of Barley.
3. Any variety of Oats.
4. Perennial Rye Grass.

5. County of NAIRN: Convener, James C. Brodie of Lethen.

1. Any variety of Wheat.
2. Any variety of Barley.
3. Any variety of Oats.
4. Perennial Rye Grass.

6. County of BANFF, and Turriff District: Convener, Alexander Morison of Bognie.

1. Any variety of Early Oats.
2. Chevalier Barley.
3. Any other variety of Barley.
4. Perennial Rye Grass.

CONDITIONS.

1. In each District, the Convener will fix the time and place of Competition, appoint the Judges, and make all other necessary arrangements, in concurrence with the other Members of the Society, and the Local Association of the District. Conveners will be furnished with blank Schedules for returning the awards.

2. The quantity shown in Competition by each Grower must not be less than three quarters of each variety of grain, two quarters of Beans, Pease, Vetches, or Grass-Seeds, and half a Ton of Potatoes. To authorize the award of the Medal, there must at least be two Competitors. The sum of £2, awarded by the District, may be divided into two Premiums.

3. The Judges shall be guided in their awards—*1st*, By the purity of the Seed; *2d*, By its freeness from extraneous Seeds; And, *3d*, Where there is an equality in these respects, by the weight. Competitors must have previously certified that the Grain, Grasses, Beans, &c., exhibited, are fair average specimens of what have been thrashed, and that the lots have in no way been picked or sorted.

4. Successful Competitors must immediately transmit to the Society's Museum, George IV. Bridge, Edinburgh, free of expense, a sample of the Seed. If it is Grain or Grass, the quantity must not be less than two quarts.

5. The Returns must show, as accurately as possible, the produce per imperial acre, as also the altitude, exposure, and nature of the soil on which the crops were raised, together with the dates of sowing and reaping, and, in the case of Grain or Grass-Seed, the weight per bushel. The varieties for which Premiums have been given, must be named. Reports of the several Competitions must be lodged by the 15th of October.

The Medals will be continued in each District for five consecutive years. Applications from other Districts must be lodged with the Secretary of the Society by 1st November next.

2. GREEN CROPS ON SMALL POSSESSIONS.

With the view of improving the cultivation of small possessions, by the introduction of Green Crops, the following premiums, one-half of which is contributed by the respective Districts, will be awarded:—

For the best Green Crop—Three Sovereigns.
For the second best do.—Two-and-a-half Sovereigns.
For the third best do.—One-and-a-half Sovereign.
For the fourth best do.—One Sovereign.

DISTRICTS.

1. The Parishes of KENMORE and KILLIN, including the portion of the Parish of WEEM on Loch Tay.—Convener, James F. Wyllie, Bolfracks.
2. The Island of SKYE.—Convener, Lord Macdonald, or his Factor.
3. The *Quoad Sacra* Parish of NEW PITSLIGO.—Convener, Sir John S. Forbes, Bart.
4. The Mainland, or any of the Islands of ORKNEY.—Conveners, David Balfour of Balfour, and J. G. Heddle of Melsetter.

CONDITIONS.

1. The Competition to be limited to Tenants occupying not more than 40 acres of land, and to be under the charge of the Society's Members in the different Districts.

2. At least one-half of the Green Crop to be Turnips, and that portion which is in Green Crop in 1856 should be sown out, with sufficient quantities of Clovers and Rye Grass, with the White Crop in 1857.

3. Should there be only one Competitor, the Committee may allow him such portion of one of the Premiums as they may think merited. The Committee may withhold all or any portion of the Premiums.

4. Inspectors, to be fixed by the respective Committees, shall decide the Premiums.

5. The awards to be intimated to the Secretary of the Society on or before the 1st of November in each year, and Conveners are particularly requested to state in their Reports the proportion of each Lot cropped, as above mentioned; and to offer any suggestions which they may consider of importance.

3. PLOUGHING COMPETITIONS.

The Silver Medal will be given to the Winner of the first Premium at Ploughing Competitions, where there are fifteen Ploughs, and Premiums to the amount of Three Sovereigns. To authorize the issue of the Medal, a Report, in the following terms, must be made to the Secretary, within one month of the date of the Competition, by a Member of the Society:—

I of Member of the Highland and Agricultural Society, hereby certify, that I attended a Ploughing competition at on the when ploughs competed; of land was assigned to each, and hours were allowed for the execution of the work. The sum of £ was awarded in the following proportions, viz.:

[Here enumerate the names and designations of successful Competitors.]

A Ploughman is to receive no assistance, and his work is in no respect to be touched by others.

In estimating the work of Competitors, attention should be directed to its sufficiency below, as well as to its neatness above the surface.

On land of average tenacity, the rate of ploughing should not be less than will turn over an imperial acre in ten hours.

A Ploughman can not carry more than one Medal in the same year.

A Member can only report one Match in the same year.

4. REAPING MACHINES.

With the view of encouraging the management of Reaping Machines, the Silver Medal will be given to the Servant found most expert at a trial when not less than Six Machines have started, and Premiums to the amount of Three Sovereigns are awarded in

the District. Reports must be lodged with the Secretary by a Member who was present, within One Month of the trial.

5. MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

The Society being anxious to co-operate with Local Associations in their efforts to promote improvement, will give a limited number of Medals annually, in addition to the Money Premiums which may be awarded to Tenants by such Associations—

1. For the best managed FARM.

Applied for by the Nairnshire Farming Society.—Convener, James Campbell Brodie of Lethen.
By the Inverness Farmers' Society.—Convener, Arthur Forbes of Culloden.
By the Carrick Farmers' Society.—Convener, P. W. Kennedy of Drumellan.
By the East Kilpatrick Society.—Convener, Archibald Compbell Colquhoun, yr. of Killermont.

2. For the best managed DAIRY.

Applied for by the Bute Farmers' Society.—Convener, Thos. Gibson of Spittal, M.D.

3. For the best managed GREEN CROP.

Applied for by the Ythanside Farmers' Club.—Convenor, Charles Napier Gordon of Eslemont.
By the Bute Farmers' Society.—Convener, Thomas Gibson of Spittal, M.D.
By the Lower Annandale Agricultural Society.—Convener, Colonel Graham of Mossknow.
By the Inverness Farmers' Society.—Convener, Arthur Forbes of Culloden.
By the District of Breadalbane.—Convener, James F. Wyllie, Bolfracks.
By the Dalrymple Farmers' Society.—Convener, James Campbell of Craigie.
By the East Kilpatrick Society.—Convener, Archibald Campbell Colquhoun, yr. of Killermont.
By the Leochel-Cushnie Society.—Convener, Arthur Forbes, W.S.
By the Clackmannan Farmers' Society.—Convener, James Johnstone of Alva, M.P.

4. For the best kept FENCES.

Applied for by the East of Berwickshire Farmers' Club.—Convener, David Milne Home of Wedderburn.

5. For the best kept DUNGHILL.

Applied for by the District of Breadalbane.—Convener, James F. Wyllie, Bolfracks.

6. To the Labourer most expert and efficient in opening and filling Drains, and otherwise executing the works necessary in thorough Draining.

Applied for by the Nairnshire Farming Society.—Convener, James Campbell Brodie of Lethen.

By the Carrick Farmers' Society.—Convener, P. W. Kennedy of Drumellan.

7. To the Labourer most expert in Cutting Hedges.

Applied for by the East of Berwickshire Farmers' Club.—Convener, David Milne Home of Wedderburn.

The Medals to be issued will be limited to ten in each class. Reports of the several Competitions must be lodged by the 15th of October, and applications for 1857 must be lodged by 1st November next, accompanied with a guarantee, that, in addition to the Medal, Premiums of not less than £3 will be given by the District applying.

CLASS V.

COTTAGES AND GARDENS.

The following Premiums are offered for competition in the Parishes after mentioned. The Medals and one-half of the Premiums are given by the Society, and the other half is contributed by the respective Parishes.

COTTAGES.

1. For the best kept Cottage in each Parish—One Pound Five

Shillings; and where there are four Competitors—The Silver Medal.

2. For the second best—One Pound.

3. For the third best—Fifteen Shillings.

GARDENS.

1. For the best kept Cottage Garden in each Parish—One Pound Five Shillings; and where there are four Competitors—The Silver Medal.

2. For the second best—One Pound.

3. For the third best—Fifteen Shillings.

PARISHES.

Dumbartonshire.

BONHILL.—Convener, Alexander Smollett of Bonhill, M.P.

Forfarshire.

CRAIG.—Convener, William M. Macdonald of St Martins.

Lanarkshire.

LAMINGTON.—Convener, Alexander Baillie Cochrane of Lamington.
LESMAHAGOW.—Convener, W. E. Hope Vere of Blackwood.

Orkney.

SHAPINSHAY.—Convener, David Balfour of Balfour.

Wigtownshire.

KIRKCOLM.—Convener, David Guthrie.
LESWALT.—Convener, Sir Andrew Agnew of Lochnaw, Bart.
PORT-PATRICK.—Edward Hunter Blair of Dunskey.
OLD LUCE.—Captain Dalrymple Hay.

CONDITIONS.

1. Competitions may take place in the different Parishes for Cottages and Gardens, or for either separately.

2. In either case, the occupiers of Gentlemen's Lodges and Gardeners' Houses are excluded, as well as Gentlemen's Servants occupying Cottages in the policies, or on land in the natural possession of their masters. The inspection must be completed by the 1st of October. In making the inspection, the Conveners may take the assistance of any competent judge.

3. The annual value of each Cottage, with the ground occupied in the parish by a Competitor, shall not (except in the parish of Shapinshay) exceed £5 sterling. A Competitor who has gained a Premium in a previous year, cannot compete again for the same or a lower Premium.

4. If the Cottage is occupied by the proprietor, the roof must be in good repair; if the roof is of thatch, it must be in good repair, though in the occupation of a tenant. The interior, and the external conveniences, must be clean and orderly,—the windows must be free of broken glass, clean, and affording the means of ventilation. Dunghills, and all other nuisances, must be removed from the front and gables. In awarding the Cottage Premiums, preference will be given to Competitors who, in addition to these requisites, have displayed the greatest taste in ornamenting the exterior of their houses, and the ground in front and at the gables.

5. In estimating the claims for the Garden Premiums, the Judges should have in view—the sufficiency and neatness of the fences; the cleanness of the ground, and neatness of the walls; the quality of the crops, and general productiveness of the garden; and the choice of crops.

6. Reports stating the number of Competitors, the names of successful parties, and the nature of the exertions which have been made by them, must be transmitted by the Conveners to the Secretary on or before the 15th of October next.

Parishes desirous of these Premiums must lodge applications with the Secretary on or before the 1st November next.

MEDALS FOR COTTAGES OR GARDENS.

The Society will issue annually twelve Medals to Local Associations, or individuals, who, at their own expense, establish Premiums for Cottages or Gardens.

The Medals will be issued upon a Report by a Member of the Society in the terms required by the preceding conditions, describing the merits of the Cottages or Gardens. The Reports to be lodged with the Secretary on or before the 15th October 1856.

Applied for by The Peeblesshire Agricultural Society.
The Linlithgow Agricultural Society.
Lord Kinnaird.
Mrs Douglas Baird of Closeburn.

IMPROVING EXISTING COTTAGES.

To the Proprietor in Scotland who shall report the Improvement of the greatest number of Cottages in the years 1853, 1854, and 1855—The Gold Medal.

BUILDING NEW COTTAGES.

To the Proprietor in Scotland who shall report the erection of

the greatest number of approved Cottages during the years 1852, 1853, 1854, and 1855—The Gold Medal.

CONDITIONS.

Claims for the above Premiums must be lodged with the Secretary on or before the 1st of October next, to allow an inspection to be made of the different Cottages. The inspections will be conducted by Committees of the Society's Members in the different Districts; and Reports must be transmitted by the Conveners to the Secretary on or before the 1st December.

The annual value of the Cottage or Cottages separately, with garden ground, must not exceed £5.

In estimating the claims of Competitors, the following points will be kept in view—the external appearance of the Cottages, their internal accommodation; the arrangements of the outhouses; the means of drainage and ventilation; and the expense of the building or of the alteration compared with its durability and accommodation. When the Cottages of one Competitor are superior in style and comfort to those of another, though not so numerous, the Inspectors will give them the preference, provided they amount at least to three, and have been erected at a moderate expense.

Parties competing will forward plans, specifications, and estimates, to the Society, of which, and of all information sent therewith, copies may be taken for publication, if the Society shall see fit, and the originals returned to the parties within six months, if desired.

ACCOMMODATION FOR FARM-SERVANTS.

To the Proprietor in Scotland who shall have erected on his estate the most approved Farm-buildings in reference to the proper accommodation of Farm-Servants—The Gold Medal.

Reports, Plans, and Specifications, to be lodged by the 1st of November 1856.

AGRICULTURAL MEETING

AND

GENERAL SHOW OF STOCK AND IMPLEMENTS,

AT

INVERNESS,

ON THE 5TH, 6TH, 7TH, and 8TH OF AUGUST 1856.

The District in connexion with the Show comprises the Counties of Inverness—Moray and Nairn—Ross and Cromarty—Caithness—Sutherland, and—Orkney.

GENERAL ARRANGEMENTS.

TUESDAY,.... 5th August.—Arrangement and Inspection of Implements.
WEDNESDAY, 6th August.—Trial and Exhibition of Implements.
THURSDAY,...7th August.—Exhibition of Stock &c., and Public Banquet.
FRIDAY,.......8th August.—Exhibition of Prize Stock, Implements, &c.

The Competition is open to exhibitors from all parts of the Kingdom.

No Certificates of Entry can be received after Thursday the 19th of June.

Members of the Society are entitled to exhibit, free of Entry-Money, three Lots of Stock or Implements under each section of the Premium List; and they are admitted to the Show Yard without payment, *provided application for Tickets of Admission is made in Edinburgh, to the Secretary, or, in Inverness, to Mr Alexander Dallas, the local Secretary, before the* 1*st of August.*

CLASS I.—CATTLE.

SHORT-HORNED.

SECTION

1 For the best Bull calved before 1st January 1854—Twenty Sovereigns.
For the second best—Ten Sovereigns.
For the third best—Certificate of Merit.
To the breeder of the best Bull—The Silver Medal.

2 For the best Bull calved after 1st January 1854—Fifteen Sovereigns.
For the second best—Eight Sovereigns.
For the third best—Certificate of Merit.

3 For the best Bull calved after 1st January 1855—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.

4 For the best Cow of any age—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.

5 For the best Heifer calved after 1st January 1854—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—Certificate of Merit.

6 For the best Heifer calved after 1st January 1855—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.

HIGHLAND.

7 For the best Bull calved before 1st January 1853—Twenty Sovereigns.
For the second best—Ten Sovereigns.
For the third best—Certificate of Merit.
To the breeder of the best Bull—The Silver Medal.

8 For the best Bull calved after 1st January 1853—Fifteen Sovereigns.
For the second best—Eight Sovereigns.
For the third best—Certificate of Merit.

9 For the best Bull calved after 1st January 1854—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.
10 For the best Cow of any age—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.
11 For the best Heifer calved after 1st January 1853—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—Certificate of Merit.
12 For the best Heifer calved after 1st January 1854—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.
13 For the best Heifer calved after 1st January 1855—Four Sovereigns.
For the second best—Two Sovereigns.
For the third best—Certificate of Merit.

POLLED.

14 For the best Bull, calved before 1st January 1854—Twenty Sovereigns.
For the second best—Ten Sovereigns.
For the third best—Certificate of Merit.
To the breeder of the best Bull—The Silver Medal.
15 For the best Bull calved after 1st January 1854—Fifteen Sovereigns.
For the second best—Eight Sovereigns.
For the third best—Certificate of Merit.
16 For the best Cow of any age—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.
17 For the best Heifer calved after 1st January 1854—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—Certificate of Merit.

18 For the best Heifer calved after 1st January 1855—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.

AYRSHIRE.

19 For the best Bull of any age—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.
To the breeder of the best Bull—The Silver Medal.
20 For the best Cow of any age, in milk—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—Certificate of Merit.
21 For the best Cow of any age, in calf—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—Certificate of Merit.
22 For the best heifer, calved after 1st January 1854—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.

CLASS II.—HORSES

FOR AGRICULTURAL PURPOSES.

SECTION
1 For the best Stallion foaled before 1st January 1853—Twenty-five Sovereigns.
For the second best—Twelve Sovereigns.
For the third best—Certificate of Merit.
To the breeder of the best Stallion—The Silver Medal.
2 For the best entire Colt foaled after 1st January 1853—Fifteen Sovereigns.
For the second best—Seven Sovereigns.
For the third best—Certificate of Merit.
3 For the best entire Colt foaled after 1st January 1854—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—Certificate of Merit.

4 For the best entire Colt foaled after 1st January 1855—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.
5 For the best Brood Mare foaled before 1st January 1853—Fifteen Sovereigns.
For the second best—Seven Sovereigns.
For the third best—Certificate of Merit.
6 For the best Filly foaled after 1st January 1853—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—Certificate of Merit.
7 For the best Filly foaled after 1st January 1854—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.
8 For the best Filly foaled after 1st January 1855—Four Sovereigns.
For the second best—Two Sovereigns.
For the third best—Certificate of Merit.

PONIES.

9 For the best Stallion not exceeding 14 hands—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.
10 For the best Mare not exceeding 14 hands—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—Certificate of Merit.

CLASS III.—SHEEP.

SECTION LIECESTER.

1 For the best Tup, not more than four shear—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.

2 For the best Dinmont or Shearling Tup—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.
3 For the best pen of five Ewes, not more than four shear—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.
4 For the best pen of five Shearling Ewes or Gimmers—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.

CHEVIOT.

5 For the best Tup, not more than four shear—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.
6 For the best Dinmont or Shearling Tup—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.
7 For the best pen of five Ewes, not more than four shear—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.
8 For the best pen of five Shearling Ewes or Gimmers—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.

BLACKFACED.

9 For the best Tup, not more than four shear—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.
10 For the best Dinmont or Shearling Tup—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.

11 For the best pen of five Ewes, not more than four shear—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.

12 For the best pen of five Shearling Ewes or Gimmers—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.

SOUTHDOWN.

13 For the best Tup, not more than four shear—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.

14 For the best Dinmont or Shearling Tup—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.

15 For the best pen of five Ewes, not more than four shear—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.

16 For the best pen of five Shearling Ewes or Gimmers—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.

LONG-WOOLLED OTHER THAN LEICESTER.

17 For the best Tup, not more than four shear—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—Certificate of Merit.

18 For the best pen of five Ewes, not more than four shear—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.

CLASS IV.—SWINE.

SECTION

1 For the best Boar, large breed—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.

2 For the best Boar, small breed—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—Certificate of Merit.
3 For the best Sow, large breed—Four Sovereigns.
For the second best—Two Sovereigns.
For the third best—Certificate of Merit.
4 For the best Sow, small breed—Four Sovereigns.
For the second best—Two Sovereigns.
For the third best—Certificate of Merit.
5 For the best pen of Three Pigs, not exceeding eight months old—Four Sovereigns.
For the second best—Two Sovereigns.
For the third best—Certificate of Merit.

EXTRA STOCK.

Animals of Breeds or Ages not included among the foregoing Premiums may be entered as EXTRA STOCK.

CLASS V.—POULTRY.

DORKING—*Coloured.*

SECTION
1 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

DORKING—*White.*

2 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

COCHIN-CHINA—*Coloured.*

3 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

COCHIN-CHINA—*White.*

4 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

BRAMAHPOOTRA.

5 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

MALAY.

6 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

SPANISH.

7 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

HAMBURGH—*Golden.*

8 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

HAMBURGH—*Silver.*

9 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

POLAND.

10 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

GAME.

11 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

ANY OTHER DISTINCT BREED.

12 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

BANTAMS.

13 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

CAPONS.

14 For the best 3 Capons—The Silver Medal.
For the second best—Certificate of Merit.

DUCKS—*White Aylesbury*.

15 For the best Drake and 2 Ducks—The Silver Medal.
For the second best—Certificate of Merit.

DUCKS—*Rouen*.

16 For the best Drake and 2 Ducks—The Silver Medal.
For the second best—Certificate of Merit.

DUCKS—*Any other Breed*.

17 For the best Drake and 2 Ducks—The Silver Medal.
For the second best—Certificate of Merit.

TURKEYS—*Black Norfolk*.

18 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

TURKEYS—*Any other Breed*.

19 For the best Cock and 2 Hens—The Silver Medal.
For the second best—Certificate of Merit.

GEESE.

20 For the best Gander and 2 Geese—The Silver Medal.
For the second best—Certificate of Merit.

CLASS VI.—IMPLEMENTS AND MACHINES.

SECTION.

1 For the best Two-horse Plough for general purposes—Three Sovereigns.

2 For the best Trench or Deep-Furrow Plough—Three Sovereigns.

3 For the best Subsoil Plough for two horses—Four Sovereigns.

4 For the best Subsoil Plough for moor and stony land, for three or four horses—Four Sovereigns.

5 For the best Double Mould-Board Plough for forming Drills—Three Sovereigns.

6 For the best Ribbing or Drill-Paring Plough—Two Sovereigns.

7 For the best Improvement on, or Substitute for, the Common Plough, in lifting Potatoes—Three Sovereigns.

8 For the best Two-Horse Grubber or Cultivator—Four Sovereigns.

9 For the best Drill-Grubber for Green Crops—Two Sovereigns.

10 For the best Norwegian Harrow—Four Sovereigns.

11 For the best Consolidating Land-Roller—Five Sovereigns.

12 For the best Land-Presser, for preparing Seed-bed for Grain—Five Sovereigns.

13 For the best Ribbing Machine—Two Sovereigns.

14 For the best Pulverizing Land-Roller—Five Sovereigns.

15 For the best Harrows for heavy land—Three Sovereigns.

16 For the best Harrows for light land—Three Sovereigns.

17 For the best Common Swing-Trees or Draught-Bars—One Sovereign.

18 For the best Equalizing Swing-Trees or Draught-Bars—One Sovereign.

19 For the best Broadcast Sowing-Machine for Grain and Grass Seeds—Six Sovereigns.

20 For the best Drill Sowing-Machine for Grain—Six Sovereigns.

21 For the best Horse-Hoe for Drilled Grain Crops—Six Sovereigns.
22 For the best Sowing-Machine for Turnips—Four Sovereigns.
23 For the best Sowing Machine for Turnips with Manure—Five Sovereigns.
24 For the best Dibbling or Drop Sowing-Machine for Turnips with Manure—Three Sovereigns.
25 For the best Three-row Sowing-Machine for Beans—Four Sovereigns.
26 For the best One-row Bean Sowing-Machine—One Sovereign.
27 For the best Dry Manure Distributing Machine—Four Sovereigns.
28 For the best Liquid Manure Distributing Machine—Four Sovereigns.
29 For the best Liquid Manure Pump—Two Sovereigns.
30 For the best Straw-Cutter for hand labour—Two Sovereigns.
31 For the best Straw-Cutter for power—Three Sovereigns.
32 For the best Turnip-Cutter for Sheep—Two Sovereigns.
33 For the best Turnip-Cutter for Cattle—Two Sovereigns.
34 For the best Turnip-Cutter for Sheep, adapted for attachment to a Cart—Three Sovereigns.
35 For the best Linseed-Bruiser for hand labour—Two Sovereigns.
36 For the best Grain and Linseed-Bruiser for power—Four Sovereigns.
37 For the best Root-Washer—Two Sovereigns.
38 For the best Steaming apparatus for preparing Food—Five Sovereigns.
39 For the best set of Troughs for Feeding Byres—One Sovereign.
40 For the best Sheep Fodder Rack—Two Sovereigns.
41 For the best One-Horse Farm-Cart—Four Sovereigns.
42 For the best Light Spring-Cart—Four Sovereigns.
43 For the best Harvest Cart—Four Sovereigns.
44 For the best Apparatus for conveying Implements to different parts of the Farm—Three Sovereigns.

45 For the best Stone or Iron Stack Pillars, with Framework—Two Sovereigns.
46 For the best Horse Stubble or Hay Rake—Two Sovereigns.
47 For the best Scythe for general purposes—One Sovereign.
48 For the best Improvement on any part of the Thrashing Machine—Five Sovereigns.
49 For the best Thrashing Machine, adapted for two or more horses—Six Sovereigns.
50 For the best Thrashing Machine, with English high-speed open Drum, combined with Shakers, Fanners, &c., on the Scotch principle—Ten Sovereigns.
51 For the best Hummeler, for attachment to a Thrashing Machine—Three Sovereigns.
52 For the best Dressing Fanners—Four Sovereigns.
53 For the best Weighing Machine for the Barn, indicating measure and weight of Grain at one operation—Four Sovereigns.
54 For the best Weighing Machine indicating from 1 lb. to 2 tons—Four Sovereigns.
55 For the best Churn worked by hand—Two Sovereigns.
56 For the best Churn worked by power—Three Sovereigns.
57 For the best Cheese Press—Two Sovereigns.
58 For the best Curd Cutter for Dairy purposes—One Sovereign.
59 For the best general set of the Smaller Utensils of the Dairy—One Sovereign.
60 For the best Field Gate, constructed entirely of Iron—One Sovereign.
61 For the best Field Gate, not constructed entirely of Iron—One Sovereign.
62 For the best six Iron Hurdles for a Fence to retain Cattle—Two Sovereigns.
63 For the best set of Traverse Divisions, Rack, and Manger, for Farm Stables—Two Sovereigns.
64 For the best set of Farm Harness—One Sovereign.
65 For the best set of Tiles and Pipes for Field Drainage—One Sovereign.
66 For the best set of Glazed Socketed Pipes for Sewerage—One Sovereign.

67 For the best set of Tools for Cutting Field Drains—One Sovereign.

68 For the best set of Tools for Cutting Open Drains in Hill Pastures—One Sovereign.

69 For the best general set of Hand Implements for the Farm—Two Sovereigns.

70 For the best Dynamometer for general purposes—Five Sovereigns.

EXTRA IMPLEMENTS.

Premiums to the amount of Thirty Sovereigns, and Certificates of Merit, will further be awarded for Inventions or Improvements not included among the foregoing, but entered on the EXTRA LIST, and specially commended by the Judges.

GENERAL REGULATIONS.

1. Members of the Society may exhibit, free of entry-money, three Lots of Stock or Implements, or one Lot of Poultry, under any section. For Stock, Members shall pay on each Lot exceeding three in one section, and non-Members on all Lots—2½ per cent., or Sixpence in the Pound, on the amount of the highest Premium for which the entry is made. For Implements and Poultry, Members shall pay 2s. 6d. on each Lot exceeding the privileged number, and non-Members the same amount on all Lots.

2. Stock must be the property and in the possession of the Exhibitor from the date of the Certificate of Entry, and the age must be stated in the Certificate.

3. Cows and Mares must have had produce in 1856, or be in calf or in foal at the time of the Show, in which case the Premium will be withheld till certificate of birth.

4. Evidence may be required that Stallions and Bulls have had produce.

5. Ewes and Gimmers must be taken from regular breeding hirsels, and Ewes must rear lambs in 1856.

6. An Animal which has already gained a first Premium at a General Show of the Society, cannot again compete in the same class, but may be exhibited as Extra Stock for the Silver Medal.

7. The Premiums awarded will be paid on or after the 10th of February 1857. *Premiums not applied for within two years from the term of payment will be forfeited.*

8. The decisions of the Judges, as sanctioned by the Directors, are final, and no appeal is competent.

CERTIFICATES OF ENTRY.

1. Each Lot must be intimated by a Certificate of Entry, printed forms of which may be had on application to the Secretary, at No. 6 Albyn Place, Edinburgh; or to Mr Alexander Dallas, at Inverness, the Local Secretary.

2. All Entries must be completed and lodged with the Secretary not later than Thursday the 19th of June.

3. Admission Orders to the Show-Yard will be given when the Certificates of Entry are lodged.

PLACING AND JUDGING IMPLEMENTS.

1. The Show-Yard will be open for the reception of IMPLEMENTS on Monday, the 4th of August, and all Articles must be placed by 12 o'clock, on Tuesday the 5th of August. No article will be admitted without an admission-order, and the different articles must be placed in their respective Sections according to the classification in the Premium List.

2. A separate space will be reserved for Exhibitors who are desirous of shewing a general collection. A moderate charge will be made, according to the ground required, the extent of which must be intimated to the Secretary on or before the 19th June.

3. The Judges will commence their inspection on the 5th of August, at Twelve, and they will resume it the following morning at Seven. Practical utility will be considered more than mere ingenuity of design; substantial workmanship will be preferred to highly finished execution; and due weight will in all cases be given to economy, both as regards the price of the Implement, and the saving of labour effected by it. The materials must be the same as those in ordinary use for sale, and the *bonâ fide* price must be attached.

4. A trial of implements will take place during the forenoon of Wednesday the 6th; and at One o'clock the Yard will be opened to the Public.

5. All articles entered, whether in Competition or for General Exhibition, must remain in the Yard till Four o'clock on Thursday the 7th of August.

PLACING AND JUDGING STOCK.

1. Stock and Poultry must be brought to the Show-Yard between Five and Seven o'clock on the morning of Thursday the 7th of August. No lot will be admitted without an admission-order. At Seven o'clock the Show-Yard will be cleared of all persons except the Judges.

2. One Servant will be admitted with each Lot, and he must remain strictly in charge of it during the Show. Bulls must be secured by a ring or screw in the nose, with a chain or rope attached. The competing Stock will be distinguished by numbers, and the Owner's name must not be mentioned till the Premiums are decided.

3. The Judges will commence their inspection at Seven o'clock. They will decide without inquiry as to names of parties or places, and with reference merely to the numbers which distinguish the animals. They will have regard to the symmetry, early maturity, purity, size, and general qualities characteristic of the different breeds; and they will be prohibited from awarding Premiums to overfed animals, the object of the Society being to discourage the practice of showing breeding stock in an improper state of fatness. In no case shall a premium be awarded unless the Judges deem the animals to have sufficient merit, more especially if there is only one Lot in a section; and it shall be in their power to suggest the removal of any lot which appears to them unworthy of being placed in the yard.

4. A Member of Committee will attend each Section of the Judges. It will be his duty to see that no obstruction is offered to them; to communicate between them and the secretary; to complete their reports; and to ticket the

prize animals. None of the tickets so placed shall be removed. The Yard will be open to the Public on Thursday at Eleven o'clock.

5. On Thursday the Stock will be withdrawn, and the Show-Yard closed at Four o'clock.

EXHIBITION OF PRIZE STOCK.

All the Prize Animals, Implements, and other articles must be on the Show-Ground by Ten o'clock on the morning of Friday the 8th of August, under penalty of forfeiting the Premiums.

Copies of the Premium List, and Regulations, and forms of Certificates of Entry to be had on application to Mr Hall Maxwell, or to Mr Alexander Dallas, Local Secretary, Inverness; Mr Arthur Harvey, Aberdeen, Secretary to the Royal Northern Society; Mr James Geddes, Orbliston, Fochabers, Secretary to the Morayshire Farmers' Club; Mr Kenneth Murray, Tain, Secretary to the Easter Ross Society, and Mr William Hossack, Dochcarty, Dingwall, Secretary to the Wester Ross Society.

AGRICULTURAL MEETING,

AND

GENERAL SHOW OF STOCK AND IMPLEMENTS,

At GLASGOW, in 1857.

The SOCIETY will hold an AGRICULTURAL MEETING, and GENERAL SHOW of STOCK and IMPLEMENTS, at GLASGOW, in 1857, when Premiums will be offered for the following Classes of Stock. The list of Implements, and the amount of the different Premiums, will be afterwards intimated.

The District connected with the SHOW will comprise the COUNTIES of LANARK, ARGYLL, AYR, BUTE and ARRAN, DUMBARTON, RENFREW, and STIRLING.

CATTLE.

AYRSHIRE.

Bulls calved before 1st January.........1855.
Bulls calved after 1st January.........1855.
Bulls calved after 1st January.........1856.
Cows in Milk calved before 1st January 1854.
Cows in Milk calved after 1st January...1854.
Cows in Calf of any age.
Heifers calved after 1st January.........1855.
Heifers calved after 1st January.........1856.

SHORT-HORN.

Bulls calved before 1st January........1855.
Bulls calved after 1st January.........1855.
Bulls calved after 1st January.........1856.
Cows of any age.
Heifers calved after 1st January.......1855.
Heifers calved after 1st January.......1856.

POLLED ANGUS, OR ABERDEEN.

Bulls calved before 1st January........1855.
Bulls calved after 1st January.........1855.
Cows of any age.
Heifers calved after 1st January........1855.

POLLED GALLOWAY.

Bulls calved before 1st January........1855.
Bulls calved after 1st January.........1855.
Cows of any age.
Heifers calved after 1st January........1855.

HIGHLAND.

Bulls calved before 1st January........1855.
Bulls calved after 1st January.........1855.
Cows of any age.
Heifers calved after 1st January.......1854.
Heifers calved after 1st January.......1855.

HORSES

For Agricultural Purposes.

Stallions foaled before 1st January.....1854.
Entire Colts foaled after 1st January..1854.
Entire Colts foaled after 1st January...1855.
Entire Colts foaled after 1st January..1856.
Brood Mares foaled before 1st January.1854.
Fillies foaled after 1st January.........1854.

Fillies foaled after 1st January...1855.
Fillies foaled after 1st January...1856.

EXTRA.

Draught Horses or Mares in Harness.
Ponies suitable for Milk Carts.

SHEEP.

LEICESTER.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

CHEVIOT.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

BLACK-FACED.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

SOUTHDOWN.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

LONG-WOOLLED SHEEP OTHER THAN LEICESTER.

Tups not more than four shear.
Ewes not more than four shear.

Note.—Ewes and Gimmers to be exhibited in pens of five.

SWINE.

Boars, large breed.
Boars, small breed.
Sows, large breed.
Sows, small breed.
Pigs not exceeding 8 months old.

POULTRY.

Dorking, *Coloured.*
Dorking, *White.*
Cochin-China, *Coloured.*
Cochin-China, *White.*
Bramahpootra.
Malay.
Spanish.
Hamburgh, *Golden.*
Hamburgh, *Silver.*
Poland.
Game.
Any other distinct breed.
Bantams.
Capons.
Ducks, *White Aylesbury.*
Ducks, *Rouen.*
Ducks, *any other breed.*
Turkeys, *Black Norfolk.*
Turkeys, *any other breed.*
Geese.

DAIRY PRODUCE.

Cured Butter.
Powdered Butter.
Fresh Butter.
Sweet-Milk Cheese.
Skimmed-Milk Cheese.
English Cheese.
Imitation English Cheese.

IMPLEMENTS.

A liberal sum of money will be set aside for Implements and Machines at Glasgow, and a list of the Articles, for which Premiums are to be offered, will be published in due time to admit of preparation.

VETERINARY COLLEGE.

This Establishment is conducted by Professor Dick, and an efficient staff of assistants. The curriculum embraces the principles and practice of Veterinary Medicine and Surgery, with Anatomy, Physiology, and Demonstrations; Chemistry; Materia Médica and Dietetics; and the general management of domesticated Animals.

Students have the advantage of assisting in an extensive practice, and of performing the different operations which most frequently occur.

Attendance on Two Courses is required before a Student is taken upon trial for diploma; the examinations are conducted by Professor Goodsir and the leading members of the Medical Faculty; and the Graduates of the College are eligible for appointments as Veterinary Surgeons in Her Majesty's Service, and that of the East India Company.

MUSEUM.

The Museum, George IV. Bridge, is open from eleven till three o'clock every day except Monday. The public are admitted on inscribing their names in the Visitors' Book. Persons desirous of preserving objects illustrative of the Vegetable products of the country, are invited to transmit them to the Conservator of the Museum.

MONTHLY MEETINGS.

Periodical Meetings are held in the Museum, when papers are read, and subjects in the science and practice of Agriculture are discussed. Strangers are admitted, but cannot take part in the business.

LABORATORY.

Dr Anderson, the Society's Chemist, will receive communications on all subjects connected with the Chemical Department, at the Laboratory, 15 Shuttle Street, Glasgow.

The following are the rates at which analyses, &c., are furnished to *Members of the Society*:—

1. Complete analysis of a Soil, including determination of alkalies and phosphates, £3.
2. A partial analysis of a Soil, such as the determination of the quantity of organic matter, and relative proportion of clay, sand, and carbonate of lime it contains, 10s.
3. Quantitative determination of any one ingredient of a Soil, 7s. 6d.
4. Complete analysis of Saline Manures and other substances such as Gypsum, Nitrates of Soda and Potash, Ammoniacal Salts, Guano, Oil-Cake, Bone-Dust, Rape-Dust, Superphosphate of Lime, £1.
5. Testing any of the above substances for adulterations,—for each sample, 5s.

   This examination is sufficient to determine whether or not any of these substances are grossly adulterated, but it gives no idea of the comparative value of different Samples where all are genuine.
6. Complete analysis of limestones, marls, shell-sands, &c., £1.
7. Examining any of the above substances for the quantity of lime, and ascertaining in the same the presence of Magnesia and Alumina, 7s. 6d.

   Ascertaining the proportion of these, 2s. 6d. additional for each substance.
8. Complete analysis of the Ash of any Plant, £3.
9. Complete analysis of a water, £2.
10. Determination of the amount of salts in solution, and of the lime thrown down by boiling in any water, 10s.
11. Analysis of Tile or Fire-Clay, £1, 10s.
12. Complete analysis of roots, grains, and other vegetable products, £1.

13. Examining products of Vegetation, or of the Dairy, such as nutritive matters in Wheat, or other grain—quantity of butter or cheese in milk—5s. for each ingredient.
14. Determination of the quantity of nitrogen in any substance, 7s. 6d.
15. Answers to letters asking advice on subjects within the department of the Chemist, 5s.

The charges for other analyses not specified in the list, will be settled by the Committee of Management, with reference to the amount of work which they involve, and on a scale similar to the above.

INSTRUCTIONS FOR SELECTING SAMPLES FOR ANALYSIS.

Much inconvenience and delay having been experienced by persons sending samples for Analysis which had not been sufficiently carefully selected, and were afterwards found not to represent the average composition of the substance, it is particularly requested that the following instructions may be attended to as closely as circumstances will permit.

Manures.—A large handful of the Manure should be taken from each of *at least* five or six different parts of the cargo, and if any lumps are found in it, a due proportion of these should also be taken. The whole being laid on a large sheet of paper, should be carefully mixed by rubbing with the hand, the lumps being broken down and mixed as uniformly as possible with the powdery part. If this mixture be carefully made, a quantity of it not exceeding *two ounces* will suffice for the analysis. It should be folded up in tinfoil to prevent its becoming dry, and is most cheaply and expeditiously forwarded by post. In default of tinfoil, the sample may be wrapped in double folds of strong writing paper, and if the paper be well rubbed with wax, so as to make it impervious to moisture, it will answer nearly as well. Should the manure contain stones, or be very moist, or should any difficulty be experienced in making a uniform mixture, it is desirable that *two or three pounds* should be sent.

Soils.—In selecting Soils for Analysis, five or six spadefuls should be taken from different parts of the field, and, after being spread out in a thin layer for several days to dry, should be put

two or three times through a fine sieve, so as to insure uniform mixture. For a complete analysis, not less than *four pounds* should be sent; for a partial analysis, three or four ounces will be sufficient.

Waters.—For the complete analysis of a water, about *two gallons* are required; for the determination of the amount of salts in solution, and lime thrown down by boiling, *a quart* will suffice. A well-water may be selected at any time, but the water of a spring or running stream should be taken in dry weather. The jars or bottles in which they are sent must be tightly corked and sealed. In the analysis of a mineral water, it may sometimes be desirable to determine the amount of gases held in solution, in which case certain precautions must be observed which require the presence of a Chemist at the spring.

Limestones, Clays, Ironstones, &c.—If the bed of any of these substances of which the analysis is required be very uniform in appearance, a piece of two or three ounces weight, taken from any part of it will be enough for analysis; but, in all cases, it is better to send three or four chips from different parts of its thickness. Sometimes, where the characters of different parts of the bed vary much, separate analyses of these portions may be requisite, in which case two ounces of each may be sent.

Every sample sent for analysis should be distinctly labelled, and marked with the name and address of the sender in full, and mentioning whether he is a Member of the Society, and in the case of imported manures, the name of the ship should, if possible, be stated. All samples should be accompanied by a letter, specifying the nature of the information required, and, if possible, the object in view, as, by doing so, much trouble and delay will occasionally be saved.

By order of the Directors,

J^N. HALL MAXWELL, *Secretary.*

EDINBURGH, 6 ALBYN PLACE,
Feb. 9, 1856.

NEILL AND CO., PRINTERS, EDINBURGH.

PREMIUMS

OFFERED BY

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

IN

1857.

CONTENTS.

PRELIMINARY NOTICE.

WHEN the HIGHLAND SOCIETY was instituted in the year 1784, and established by Royal Charter in 1787, its objects, comparatively, were few, and their operation was limited to matters connected with the amelioration of the Highlands of Scotland.

The patronage of certain departments, proper to that part of the country, having been subsequently committed to special Boards of Management, or undertaken by other Associations, several of the earlier objects contemplated by the Society were consequently abandoned, while the progress of Agriculture led to the adoption of others of a more general character.

The exertions of the Society, instead of being restricted to the improvement of the Highlands, were early extended to that of the Lowlands, and have in both, for above seventy years, been directed to the promotion of the science and practice of Agriculture, in all its branches.

In accordance with this more enlarged sphere of action, the original title of the Society was altered, under a Royal Charter in 1834, to THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

The leading purposes of the Institution are set forth in the following pages, where it will be found that Premiums are awarded for Reports on almost every subject connected with the cultivation of the soil; the rearing and feeding of stock; the management of the dairy; the growth of timber; the extension of Cottage Accommodation; the improvement of Agricultural Machinery and Implements; and the dissemination of Veterinary information.

Among the more important measures which have been effected by the Society, are,—

1. Agricultural Meetings and General Shows of Stock, Implements, &c., held in the Principal Towns, at which exhibitors from all parts of the United Kingdom are allowed to compete.

2. A System of District Shows, instituted for the purpose of improving the Breeds of Stock most suitable for different parts of the country, and of aiding and directing the efforts of Local Agricultural Associations.

3. The encouragement and promotion of a proper system of Agricultural education, by means of powers recently conferred by Royal Charter on "The Council of the HIGHLAND AND AGRICULTURAL SOCIETY on Education."

4. The advancement of the Veterinary Art by the establishment of a College in Edinburgh, where the Society's Diploma is conferred on Students who have passed through a regulated curriculum of study, and are found qualified to practise after a rigid examination.

5. The appointment of a Chemist for the purpose of promoting the application of science to Agriculture. Investigations on subjects of importance are conducted in the Laboratory, and published in the Transactions. Members have the privilege of applying for analyses of Soils, Manures, &c., on favourable terms.

6. The establishment of an Agricultural Museum illustrative of the vegetable products of the country.

7. Monthly Meetings during the Winter Session for the discussion of Agricultural subjects.

8. The organization of a system, under which the Agricultural Statistics of Scotland have been successfully obtained and reported to Government.

9. The periodical publication of the Transactions, which comprehend the proceedings in the Laboratory, Reports of Experiments, and other communications addressed to the Society. The Transactions are published by Messrs BLACKWOOD and SONS, Edinburgh, along with the Quarterly Journal of Agriculture.

CONSTITUTION AND ESTABLISHMENT.

The general business of the HIGHLAND AND AGRICULTURAL SOCIETY is conducted under the sanction and control of a Royal Charter, which authorizes the Enactment of Bye-Laws. Business connected with Agricultural Education is conducted under the authority of a Supplementary Royal Charter, also authorizing the Enactment of Bye-Laws.

The Office-Bearers consist of a President, Four Vice-Presidents, Ten Extraordinary, and Thirty Ordinary Directors, a Treasurer, and an Honorary and an Acting Secretary. The Council on Education under the Supplementary Charter, consists of Seventeen Members—Ten nominated by the Charter, and Seven elected by the Society. The proceedings of the Directors are reported to Half-yearly General Meetings of the Society, held in January, and in June or July.

New Members are admitted at either of these General Meetings by Ballot. The ordinary subscription is £1, 3s. 6d. annually, which may be redeemed by one payment, varying according to the number of previous annual payments, from £12, 12s. to £7, 1s. Tenant Farmers are admitted on a subscription of 10s. annually, or £5, 5s. for life.

The Premiums awarded by the Society are payable after the 10th February for the preceding year. Orders, payable at the Royal Bank of Scotland, are issued at the Society's Hall, on the stamped receipt of parties to whom the Premiums have been adjudged being presented, or receipts may be transmitted through a Bank, addressed to the Secretary, if done without expense to the Society. The receipt must specify distinctly the Premium in discharge of which it is sent.

Premiums not applied for within two years from the term of payment will be forfeited.

All communications are to be addressed to the Secretary of the Society, 6 Albyn Place, Edinburgh.

ESTABLISHMENT FOR 1857.

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Chemistry,	Professor GREGORY.
Cottages,	ROBERT G. BAILLIE of Culterallers.
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Finance,	ANTHONY MURRAY of Dollerie.
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Museum,	Professor BALFOUR.
Premiums,	DAVID LOW of Laws.
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Veterinary College,	Professor GOODSIR.

Council on Education.

Members of Council named by Charter.

The DUKE OF HAMILTON AND BRANDON, President of the Society, *Chairman.*

The Lord Justice-General.
The Lord Advocate.
The Dean of Faculty.
The Professor of Agriculture.
The Professor of Anatomy.
The Professor of Botany.
The Professor of Chemistry.
The Professor of Natural History.
The Professor of Technology.

Members of Council named by Society.

Sir GEORGE CLERK, Bart.
Sir W. GIBSON-CRAIG, Bart.
Sir ALEXANDER C. GIBSON MAITLAND, Bart.
JOHN FINNIE, Swanston.
JOHN MILLER of Leithen.
ROBERT RUSSELL, Kilwhiss.
JOHN WILSON, Edington Mains.

Monthly Meetings.

The DUKE OF BUCCLEUCH, K.G., *Chairman.*
Sir A. C. GIBSON-MAITLAND, Bart.; Sir JOHN M'NEILL, G.C.B.; DAVID LOW of Laws; and DAVID MILNE HOME of Wedderburn, *Deputy-Chairmen.*

PREMIUMS.

GENERAL REGULATIONS FOR COMPETITORS.

ALL Reports must be legibly written on only one side of the paper, and must specify the number and subject of the Premium for which they are in Competition; they must bear a distinguishing motto, and be accompanied by a sealed letter similarly distinguished, containing the name and address of the Reporter; initials must not be used.

None of the sealed letters, except those relative to reports found entitled to at least one-half of the Premium offered, will be opened without the Author's consent.

Reports, for which a Premium, or one-half of it, has been awarded, become the property of the Society, and cannot be published, in whole or in part, nor circulated in any manner, without the consent of the Directors. All other papers will be returned to their Authors if applied for within twelve months.

When a Report is unsatisfactory, the Society is not bound to award the whole, or any part of a premium.

All Reports must be of a practical character, containing the results of the writer's own observations or experiment, and the special conditions attached to each premium must be strictly fulfilled. General Essays, and Papers compiled from books, will not be rewarded.

Weights and Measurements must be indicated by the new or imperial Standards. The decisions of the Board of Directors, confirmed by the Society, are final and conclusive as to all Premiums, whether offered for Reports, or at General or District Shows, and it shall not be competent to raise any question or appeal touching such decisions before any other tribunal.

Reports on subjects not included in the Premium List will be received, and honorary rewards will be given, when merited.

CLASS I.

REPORTS.

SECTION 1. ON SUBJECTS CONNECTED WITH THE SCIENCE AND PRACTICE OF AGRICULTURE.

1. FARM MANAGEMENT.

For an approved Report on the best mode of managing a Farm, affording an example of high farming combined with profit—The Gold Medal, or Ten Sovereigns.

The Report should contain a full description of the Farm—of the system on which it has been managed and cultivated—and of the improvements that have been effected; the expenditure and returns should be given, and the mode of accounting explained.

The Reporter is required to consider how much extra or imported manure is required to maintain, in high condition, a farm of 300 acres, cultivated on a four-course shift, when potatoes, forming one half of the green crops, and the grass, made into hay, may both be sold off the farm.

Reports to be lodged by 1st November 1858.

2. LEASES.

For an approved Report on the form and conditions of a Lease, containing covenants equally advantageous for landlord and tenant, and not unnecessarily interfering with the management of the farm —The Gold Medal, or Ten Sovereigns.

1. When the farm is received and is to be kept and left by the incoming tenant in the best condition.
2. When the farm has been left by the outgoing tenant in the worst condition, and is to be restored to and kept by the incoming tenant in the best condition.

Reports to be lodged by 1st November 1857.

3. DRAINAGE OF SHEEP FARMS.

For an approved Report on the best system of draining Sheep Farms in mountainous districts—The Gold Medal, or Ten Sovereigns.

The Report, while based on practical observation and actual opera-

tions, must consider the general principles which should regulate the drainage of pastoral districts, the probable outlay, and the returns that may be looked for. As information has already been obtained regarding drainage on low lands, the Report must have reference to sheep-walks in a hill district.

Reports to be lodged by 1st November 1857.

4. RIVER EMBANKMENTS.

For an approved Report on the best methods of embanking and otherwise protecting low lands adjoining rivers and burns from floods, as well as for protecting the natural banks of streams from injury and dilapidation—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1857.

5. COTTAGES.

For an approved Report on the best construction and arrangement, and on the most suitable fittings for Labourers' Cottages in different districts, and under different circumstances—The Gold Medal, or Ten Sovereigns.

The Report must state the principles which should regulate the character of the accommodation most suitable for different districts and circumstances. The internal fittings must be described, and the applicability and expediency of all recent improvements must be considered.

The Report must be illustrated by drawings or plans, and must embrace statements of cost.

Reports to be lodged by 1st November 1857.

6. DEEP PLOUGHING.

For an approved Report on the comparative results obtained by the following modes of Ploughing:—1st, With a furrow not less than eight inches; 2d, With a furrow not less than ten inches; 3d, By Subsoiling—The Gold Medal, or Ten Sovereigns.

The land operated on must have been thoroughly drained. The description of Plough used in each operation, and its maker's name, must be given, and the value of the experiment will be enhanced were the same operation conducted with ploughs of different kinds. The Report must state the nature of the soil and subsoil, and the date, depth, and expense, of each ploughing. The extent of land

to be not less than one acre for each operation, and, on each lot, the produce of two separate portions, of not less than 20 poles, to be weighed or measured. In every other respect than ploughing the whole land to be treated alike.

Reports to be lodged by 1st November 1857.

7. EFFECT OF SPECIAL MANURES OVER A ROTATION.

For an approved Report, to be made after a rotation, on the comparative effects, immediate and continued, of different special Manures—Thirty Sovereigns.

As the object of the premium is to encourage experiments for determining the value of various applications, as regards not only increased quantity and improved quality of crops, but also the permanence of the different substances throughout the rotation, the report must have special reference to points such as specific gravity and quality of Turnips; weights of grain, straw, and hay; effects on straw and hay for fodder, and such like. The results obtained from each application to be compared with those of the ordinary manuring of the Farm. Each experiment to be conducted on not less than one rood of land, and the whole to be repeated in duplicate.

As such experiments may already have been in operation, Reports may be lodged on the 1st May of any year.

8. SPECIAL MANURES AS SUBSTITUTES FOR GUANO.

For an approved Report of experiments conducted with a view of determining the comparative value of other substances, mixed or unmixed, as a substitute for Guano. The experiment to embrace at least two of the manufactured or saline manures, and to be made on Turnips, Grass, one or more of the Cereal Crops, and, if possible, on Beans—Twenty Sovereigns.

Reports to be lodged by 1st May 1858.

9. MANURES FOR PEAT MOSS.

For an approved Report on the best and most economical method of reclaiming and rendering productive Peat Moss,—and on the substances best adapted for fertilizing it—The Gold Medal, or Ten Sovereigns.

As it is frequently difficult to cart Farm-Yard Manure on Moss for

some time after it has been drained, attention is particularly directed to the *portable* manures most efficacious in overcoming the inert properties of peat, and rendering it productive. The depth and composition of the Moss experimented on; the method of improvement adopted; the quantity of lime applied, and its effects; the nature of the Drainage; the detailed expenditure, and the results obtained—must be stated.

Reports to be lodged by 1st November 1857.

10. MANURES PRODUCED BY DIFFERENT KINDS OF FEEDING.

For an approved Report of the result of experiments for ascertaining the comparative value of Farm-Yard Manure, obtained from cattle fed upon different varieties of food, by the application of such manures to farm-crops—Twenty Sovereigns.

The Report must state the effects produced on two successive Crops by the application of manures obtained from cattle fed on different sorts of food, such as turnips and straw alone; turnips and straw, with an addition of oil-cake, flax-seed, bean-meal, grain, or other substances. The animals should be as nearly as possible of the same age, weight, condition, and maturity, and each lot should receive daily the same quantity of litter; and, except as to the difference of food, they should be treated in every respect alike.

The preparation of the Manure, by fermentation or otherwise, should be in every respect the same; and it is desirable that not less than two several experiments be made with each kind, and that the ground to which it is to be applied be as equal as possible in quality, and treated in every respect alike.

Reports to be lodged by 1st May in any year.

11. MANURE MADE WITH AND WITHOUT COVER.

For an approved Report on the comparative value of Manure made in the ordinary manner, and of Manure kept under cover till applied to the land—Twenty Sovereigns.

The experiment may either be conducted with Manure made in the open straw-yard, contrasted with that made in covered hammels or boxes, or conducted with Manure made in feeding-houses, part of which shall have been placed under cover, and part removed to the open dung-pit, and which shall be kept carefully unmixed with any other Manure. Preference will be given to experiments embracing both of these modes. The Cattle must be fed and littered

alike. There must be at least an acre of land experimented on with each sort of Manure—the different lots must be manured to the same extent, and be of equal quality of soil, and on two separate portions of each, not less than 20 poles; the crops must be accurately measured. The result, as given by two successive crops, to be reported.

Reports to be lodged by 1st May in any year.

12. MANURE HEAPS.

For an approved Report on the best mode of economising and increasing the quantity of Manure produced on the farm, and on the general chemical principles which should regulate the operations of the practical farmer in the making of Farm-Yard Dung—The Gold Medal, or Ten Sovereigns.

The following points should be considered in the Report:—The effects of exposure; of regular spreading; of mixing other substances; of consolidation to a greater or less degree; of frequent turning; of absorbing in the heap, or otherwise conserving the liquid drainings; the management to be observed in removing the heap, whether for reconstruction on the field, or for immediate application, should be also considered.

Reports to be lodged by 1st November 1857.

13. SHELL AND CORAL SAND.

For an approved Report on the application of Shell, or of Coral Sand as a fertilizer—The Gold Medal, or Ten Sovereigns.

The Report must state the quantity of Shell or Coral Sand available in a district, its composition, the mode of applying it, the expense of the application, and the results obtained, as compared with those of an experiment with the same crop in similar land without the application. The price at which the sand can be purchased, and the facilities for exporting it, to be stated.

Competitors to send samples of the sand experimented with to Dr Anderson.

Reports to be lodged by 1st November 1857.

14. TOP-DRESSING FOR PASTURE.

For an approved Report on the substances which may be most

profitably employed in Top-dressing Pasture.—The Gold Medal, or Ten Sovereigns.

The Report must state the nature of the substances used, the time and cost of the application, and the comparative results, which must be contrasted with those obtained from a portion of the same field to which no top-dressing was applied.

The substances recommended for trial are guano, nitrate of soda, sulphate of ammonia, superphosphate of lime, sulphate of potash, and muriate of potash, but competitors are not restricted to these or any other substances.

Reports to be lodged by 1st November 1857.

15. AUTUMN MANURING.

For an approved Report on the comparative advantages of applying Manure to the Stubble in Autumn, or in the drills in Spring, for Turnips, Potatoes, or Beans—Twenty Sovereigns.

The experiment must extend over three years, and comprise, 1st, The green crop; 2d, The grain crop; 3d, The clover crop. It must be conducted on not less than four acres—one-half of which shall be dunged in autumn, and the other in spring, with equal weights of manure, made as nearly as possible in the same way, and from animals fed on substances of equivalent nutritive values. The quantities and kinds of special manures applied at any period of the rotation must be the same on each lot, and must be stated. The treatment and condition of the land prior to the experiment must be mentioned.

As the object of this premium is to determine the advantages, if any, of autumn manuring, there will be no restriction as to labouring the land, but the Reporter must state how that was done on each lot during the experiment.

Reports to be lodged by 1st November 1858.

16. MANURES FOR GREEN CROPS.

For an approved Report of experiments for determining the kinds and quantities of manures calculated, irrespective of expense, to raise the largest and soundest green crop—whether Turnip or Potato—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1858.

17. IMPROVED VARIETIES OF AGRICULTURAL PLANTS.

For an approved Report on the means successfully employed for obtaining new and superior varieties, or improved sub-varieties, of any of the Cereal Grains, Grasses, Roots, or other Agricultural Plants—The Gold Medal, or Ten Sovereigns.

It is necessary that the varieties and sub-varieties reported upon shall have been proved capable of reproduction from seed, and also that the relation they bear to others, or well-known sorts, should be stated. The Reporter is further requested to mention the effects that he may have observed produced by different soils, manures, &c., on the plants forming the subjects of reports, and how far he may have ascertained such effects to be lasting.

Should any improved variety reported upon be the result of direct experiment by cross impregnation, involving expense and long-continued attention, a higher premium will be awarded.

Reports to be lodged by 1st November 1857.

18. DRYING AND SECURING GRAIN.

For an approved Report on the most efficient and economical mode of artificially drying the Corn and Bean crops after their separation from the ground, so as to secure, in unfavourable seasons, an early marketable condition, and the after preservation of the Grain and Straw—Fifty Pounds, or such smaller sum as the character of the invention may merit.

The Report to be accompanied by models or drawings of the requisite apparatus, by a specification of cost, both as regards original outlay and after working, and by a statement of the saving effected. The plan must not be theoretical, but have been in practical operation on a farm in Scotland, and the Report must be accompanied by proof of successful and economic results.

Reports to be lodged by 1st May 1858.

19. COMPARATIVE PRODUCTIVENESS, ETC., OF POTATOES.

For an approved Report on the comparative productiveness, and general qualities for use and keeping, of the different kinds of potatoes used in field culture—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1858.

20. COMPARATIVE PRODUCTIVENESS, ETC., OF TURNIPS.

For an approved Report of the comparative productiveness, keeping, and other qualities, of the different kinds of Swedish, Yellow, and White Turnips, generally used in field culture—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1858.

21. MANGOLD-WURZEL.

For an approved Report on the cultivation of Mangold-Wurzel in Scotland—The Gold Medal, or Ten Sovereigns.

The Reporter must state the nature and previous preparation of the soil—the varieties grown—the period of sowing—the quantity of seed per acre, and mode of sowing—the time and mode of thinning and cleaning—the best means of preventing seeding—the time and manner of storing—the crop obtained—and its comparative value for feeding purposes.

Reports to be lodged by 1st May 1858.

22. CABBAGE.

For an approved Report on the cultivation of the Cabbage, and its comparative value for feeding purposes—The Gold Medal, or Ten Sovereigns.

The experiment must be conducted on not less than one acre, and contrasted with a like extent under turnips in the same field. Both lots must have been under one rotation, and must be prepared and manured in the same manner.

Reports to be lodged by 1st May 1858.

23. DISEASE IN TURNIPS.

For an approved Report on Finger-and-Toe in Turnips, detailing the symptoms and progress of the disease, the supposed predisposing causes, and the means of prevention which have been found most efficacious—The Gold Medal, or Ten Sovereigns.

Attention is directed to Dr Anderson's Report, published in the Transactions, October 1853.

Reports to be lodged by 1st May 1858.

24. RED CLOVER.

For an approved Report, founded on actual experiment, on the success attending the cultivation of Red Clover, by sowing it at different periods—The Gold Medal, or Ten Sovereigns.

The Clover seed must be sown at three distinct times from the beginning or middle of February to the middle of May. The quantities of the seed sown to be always at the same rate per acre, and the treatment to be uniform. It will add to the value of the paper if the Reporter can state the effects of greater or smaller quantities of seed, and also, whether the ordinary mixture of Ryegrass, and White and Yellow Clover, or either of them, is prejudicial or otherwise to the growth of the Red Clover. The object of the premium being, if possible, to ascertain how the Red Clover plant may be cultivated with the greatest chance of success, the Reporter's views on the subject should be fully stated.

Reports to be lodged by 1st November 1857.

25. ITALIAN RYEGRASS.

For an approved Report, founded upon actual experiments, on the most successful and economical cultivation of Italian Ryegrass—The Gold Medal, or Ten Sovereigns.

The Reporter must state what kind has been found most profitable, whether foreign or home-grown; how many years it may be allowed to stand with advantage; when it is necessary again to plough up the land and sow it afresh with Italian Ryegrass; and how that can be best done in the shortest possible period.

Reports to be lodged by 1st November 1857.

26. VEGETABLE PRODUCTIONS OF INDIA, CHINA, AMERICA, ETC.

For an approved Report on the Hardy and useful Herbaceous Plants, including Grains and Grasses of China, Japan, the Islands of the Eastern Archipelago, the Himalaya Country, the Falkland and South Sea Islands, California, the high north-western districts of America, or any other country where such climate exists as to induce the belief that the plants may be beneficially introduced into the cultivation of Scotland—The Gold Medal, or Ten Sovereigns.

Reporters are required to give the generic and specific names of the plants treated of, with the authority for the same—together with

the native names, in so far as known; and to state the elevation of the locality and nature of the soil in which they are cultivated, or which they naturally inhabit, with their qualities or uses; and it is further requested that the descriptions be accompanied, in so far as possible, with specimens of the plants, and their fruit, seed, or other products.

Reports to be lodged by 1st November in any year.

FEEDING STOCK.

In the following experiments, the animals selected should be of the same age, sex, and breed, and, as nearly as possible, of the same weight, condition, and maturity. Their live weight before and after the experiment must be stated, and, if killed, their dead weight, and quantity of tallow.

27. BEST MODES OF HOUSING FATTENING CATTLE.

For an approved Report on the comparative advantages of fattening Cattle in stalls, in loose houses or boxes, and in sheds or hammels—Twenty Sovereigns.

The Report must detail the comparative result of actual experiments. The same quantities and kinds of food shall be used. Information is required as to the comparative expense of attendance, the cost of erecting the buildings, and any other circumstances deserving of attention. The state of the weather during the experiment in point of temperature and wetness must be particularly noted and reported.

Reports to be lodged by 1st May 1858.

28. SOILING AND PASTURING CATTLE.

For an approved Report, founded on experiment, on the comparative advantages of soiling and pasturing Cattle—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1858.

29. DIFFERENT DESCRIPTIONS OF FOOD.

For an approved Report of experiments for ascertaining the ac-

tual addition of weight to growing or fattening stock, by the use of different kinds of food—Twenty Sovereigns.

The attention of the experimenter is directed to Turnips, Carrots, Beet, Mangold-Wurzel, Potatoes, Cabbage, as well as to Beans, Oats, Barley, Indian Corn, Flax-Seed, Oil-Cake, or Rape-Cake, and to the effect of warmth and proper ventilation, and the difference between food cooked and raw. The above roots and other kinds of food are merely suggested; Competitors are neither restricted to them, nor obliged to experiment on all of them.

When experiments are made with Linseed and Oil-Cake, it is requested that attention be paid to the comparative advantages, economically and otherwise, of the substances in these two states.

Before commencing the comparative experiments, the animals must be fed equally for some time previously.

The progress of different breeds may be compared; this will form an interesting experiment of itself, for Reports of which encouragement will be given.

Reports to be lodged by 1st May 1858.

30. COMPARATIVE QUALITIES OF HAY AND STRAW AS FOOD.

For an approved Report of the result of experiments for ascertaining the comparative value of Hay and Straw when employed for feeding Cattle—The Gold Medal, or Ten Sovereigns.

The Hay and Straw must have been supplied to the Cattle under the same circumstances. The value of the experiment will be enhanced if it includes Hay of both first and second cuttings.

Reports to be lodged by 1st May 1858.

31. COMPARATIVE QUALITIES OF CAKE AND HAY FOR SHEEP.

For an approved Report on the comparative improvement and increase of weight, during a period of not less than four months, of three lots of five sheep each, fed as follows:—Five on Turnips and Oil-Cake, five on Turnips and Rape-Cake, and five on Turnips and Hay—The Gold Medal, or Ten Sovereigns.

The experiment must be so conducted and reported as satisfactorily to establish whether Oil-Cake, Rape, or Hay is the most profitable auxiliary.

Reports to be lodged by 1st May 1858.

32. PULPED TURNIPS FOR CATTLE.

For an approved Report of the result of experiments for determining the comparative feeding value of Pulped Turnips mixed with cut Straw, and of whole or sliced Turnips with Straw, either cut or uncut—Twenty Sovereigns.

The straw with the pulped turnips must be cut, but with the whole, or sliced, it may be either cut or in hecks—and the experiment would be enhanced if it embraced it in both states. The experiment must be made with cattle in all respects as nearly alike as possible, and not fewer than three in each lot, and it must extend over a period of not less than three months. The mode of pulping, and the comparative cost of that process and of slicing, and the expense generally of preparing the food, must be stated; and when oil-cake, rape, or any other substance is added, the quantities must be the same to each lot, and must be stated in the Report.

Reports to be lodged by 1st May 1858.

33. PULPED TURNIPS FOR PIGS.

For an approved Report of experiments for determining the comparative feeding value of Pulped Turnips mixed with Meal, and of the steamed food ordinarily given to pigs—The Gold Medal, or Ten Sovereigns.

The Reporter will, in as far as possible, attend to the conditions attached to the last Premium.

Reports to be lodged by 1st May 1858.

34. FEEDING SHEEP IN THE FIELD OR UNDER COVER.

For an approved Report on the comparative advantages of feeding Sheep in the open field, and in covered pens or boxes. The experiment to be made with at least two lots of five Sheep, fed alike on Turnips and any other auxiliary for not less than four months—The Gold Medal, or Ten Sovereigns.

The Report must embrace all economical elements tending to establish which is the most profitable mode of feeding.

Reports to be lodged by 1st May 1858.

35. DISEASES OF SHEEP FED ON TURNIPS.

For an approved Report on the nature, symptoms, causes, preventive and remedial treatment, and *post mortem* appearances, of the Diseases to which Sheep are subject when fed on Turnips, and on the conditions of soil and management under which such diseases are most apt to manifest themselves. The popular as well as the scientific names of diseases to be made use of—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st May 1858.

36. BRAXY IN SHEEP.

For an approved Report on the nature, symptoms, causes, preventive and remedial treatment, and *post-mortem* appearances, of Braxy in Sheep. The popular as well as the scientific names of diseases to be made use of—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1857.

37. DISEASES OF SWINE.

For an approved Report on the nature, symptoms, causes, preventive and remedial treatment, and *post-mortem* appearances, of the Diseases incidental to Swine. The popular as well as the scientific names of diseases to be made use of—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1857.

38. STAGGERS IN CATTLE.

For an approved Report on the geographical distribution and statistics, nature, symptoms, causes, preventive and remedial treatment, and *post-mortem* appearances, of Staggers in Cattle (head disease, or lead poisoning). The popular as well as the scientific names of diseases to be made use of—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1857.

39. RURAL ECONOMY ABROAD.

For an approved Report, founded on personal observation, of

any useful practice in Rural or Domestic Economy, adopted in other countries, and susceptible of being introduced with advantage into Scotland—The Gold Medal.

The purpose chiefly contemplated by the offer of this premium is to induce gentlemen who may visit other countries to notice and record such particular practices as may seem calculated to benefit their own country.

Reports to be lodged by 1st November in any year.

Section 2. WOODS AND PLANTATIONS.

1. EXTENSIVE PLANTING.

For an approved Report by a Proprietor who shall, within the five preceding years, have planted the greatest extent of ground, not being less than 150 acres. The whole planting operations that may have been conducted by the Reporter within the five years, whether completed or not, must be embraced, and he must state the expense—description of soil—age, kind, and number of trees planted per acre—mode of planting, draining, and fencing—and general state of the plantation—and any other observations of interest—The Gold Medal.

Reports to be lodged by 1st November in any year.

2. FORMATION AND MANAGEMENT OF YOUNG PLANTATIONS.

For an approved Report of Plantations formed within a period of not more than ten, nor less than five years preceding the date of the Report—The Gold Medal, or Ten Sovereigns.

The Report should comprehend every interesting particular; among others, the exposure, altitude, and general climate of the locality; the previous character and condition of the soil and subsoil; a detailed statement of the expense, including that of inclosing, draining, and fencing, and a specification of the manner in which these operations were performed—the mode of planting adopted—the prevailing weather while planting, and for a month after the operation—the kind of trees planted, and the number of each kind per acre—their relative progress—the proportion of blanks and deaths at the end of three years—the system of management—the state

of the plantations at the date of making the Report—and any other observation of interest.

Reports to be lodged by 1st November in any year.

3. GENERAL MANAGEMENT OF PLANTATIONS.

For an approved Report on the Management of Plantations, from the commencement of the first thinning till the period of yielding full-grown timber—The Gold Medal, or Ten Sovereigns.

The Report should embrace the following points:—The annual progress of the different sorts of trees—the effects of altitude and exposure—the general advantages of shelter—the mode of thinning and pruning adopted—the uses and value of the thinnings—the plan of registry and of valuing, or a specimen of the method in which the forester's book is kept—the valuation at the time of the Report—together with such general remarks as may be thought useful.

The Report is not expected to embrace the formation and early management, further than the description of soil, kinds of plants, whether mixed or in masses, together with a note of the expense from the time of planting to the commencement of the first thinning, in so far as such information is in the possession of the Reporter.

Reports to be lodged by 1st November in any year.

4. USES AND VALUE OF TIMBER.

For an approved Report on the economic uses and comparative value of different descriptions of Timber grown in Scotland—The Gold Medal, or Ten Sovereigns.

This premium may be regarded as a sequence to Nos. 2 and 3; the object being to obtain the practical and economic results of forming and of managing woods, by ascertaining the purposes to which they have been applied, and the pecuniary returns they have yielded.

The Reporter, besides stating the actual results of his own observation and experience, should indicate the objects which planters ought to have in view with reference to profitable return, by stating the kinds of trees that should be planted, the periods at which they should be cut, the purposes to which they should be applied, and the returns that may be looked for in different localities, and under different circumstances.

There must be a general description of the management, soil, altitude, exposure, &c., of the particular woods reported on, and attention is directed to the difference supposed to exist in the quality of natural and planted timber.

Reports to be lodged by 1st November in any year.

5. MIXED AND UNMIXED PLANTATIONS.

For an approved Report on mixed and unmixed Plantations—The Gold Medal or Ten Sovereigns.

As wood in a state of natural growth, both at home and abroad, is generally found unmixed, each variety occupying the soil or situation best adapted to its growth, the idea of planting on a mapped system is suggested. The Reporter will state his experience in grouping plantations—his opinion of the advantages of the system compared with mixed planting—and the soils and situations and exposures most suitable for different kinds of hard and soft wood.

Reports to be lodged by 1st November in any year.

6. COMPARATIVE QUALITIES OF SCOTCH, AUSTRIAN, AND CORSICAN FIR.

For an approved Report on the comparative value, for economical purposes, of the Scotch, Austrian, and Corsican Fir, and on their adaptation to different soils and situations—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November in any year.

7. PLANTING WITHIN THE INFLUENCE OF THE SEA, OR ON BARREN TRACTS.

For an approved Report on successful Planting within the influence of the sea, or on exposed sterile tracts, founded on observation of the habits and appearance of the different sort of trees considered best suited for such situations—The Gold Medal, or Ten Sovereigns.

The plantations reported on must be not less than ten years old.

Information is particularly desired regarding the species and varieties of trees calculated for growing in situations unfavourable to most of those generally cultivated, as bleak heaths, sandy links, exposed maritime situations, and high northern exposures.

The Reporter must specify the extent of planting and mode of drainage and fencing—the nature of the soil and subsoil—the elevation and exposure of the locality—and its distance from the sea; and, if in his power, he should notice the underlying rocks, and the geological features of the district.

Reports to be lodged by 1st November in any year.

8. ARBORETUM.

For an approved Report on the most varied, extensive, and judiciously arranged collection of hardy, or supposed hardy, forest and ornamental Trees, either *species* or marked *varieties*, of not less than five years' standing, and in Scotland—The Gold Medal, or Ten Sovereigns.

The Arboretum must be formed so as to afford ample space for the full development of the specimens. The Report must specify the nature of the locality—its altitude and exposure—the description and previous preparation of the soil—the date of planting—the system of draining—fencing—and pruning—and any other circumstances which may be supposed to influence the growth of the plants; the number of failures, with the periods when, and circumstances under which, these occurred, must also be reported. Information should be added, when in the Reporter's possession, as to the age and average height of the specimens—whether they are seedlings, cuttings, layers, or grafted plants—and, if possible, the stock on which they have been grafted.

The Report must be accompanied with a correct list, containing the names of the different species and varieties, with an authority for each, and a plan showing the disposition of each specimen. The trees in the Arboretum must be numbered and named relative to the list and plan.

Reports to be lodged by 1st November in any year.

9. PRUNING CONIFERÆ.

For an approved Report on the pruning of the rarer Coniferæ—The Gold Medal, or Ten Sovereigns.

The Reporter must consider the propriety of pruning Coniferæ as a general question, and the effects produced by pruning and by non-pruning. He will state the kinds of Coniferæ best adapted for pruning, and the period of the year, the age of the tree, and the circumstances under which it should be done; he will also

Report on the comparative effects of pointing and of pruning, and the best method of pointing when that system is adopted.

Reports to be lodged by 1st November in any year.

10. DISEASES OF FOREST TREES.

For an approved Report on the diseases incidental to Forest Trees, and the injuries they sustain from the attacks of Insects—The Gold Medal, or Ten Sovereigns.

The Report must state the kinds of Trees most generally liable to attack—the parts first affected—the age of the Tree and period of the season when first observed—the state of the drainage—the altitude and exposure of the locality, and its geological formation—the nature of the soil and subsoil—when and how the Trees were pruned—the remedies, preventive and remedial, which may have been tried. Information is required as to the causes of decay—whether attacks of insects, or cryptogamic growth—and how far either of these causes may have been induced by the previous sickly or stunted condition of the Tree. Attention is directed to the Beech, Larch, Silver Fir, and White Pine (*Pinus Strobus*), and to the Coniferæ generally, and particularly to the stripping of the leaves from Scotch and other Pines by the pine-leaf caterpillar.

Reports to be lodged by first November in any year.

11. PLANTING ON PEAT MOSS.

For an approved Report on Plantations, of not less than eight years' standing, formed on deep peat moss—The Gold Medal, or Ten Sovereigns.

It being understood that large tracts of peat moss have been profitably planted in England and Holland, it is considered desirable to obtain information on the subject. The Premium is strictly applicable to deep peat or flow moss; the condition of the moss in its original state, as well as at the date of the Report, should, if possible, be stated.

The Report must describe the mode and extent of the drainage, and the effect it has had in subsiding the moss—the trenching, levelling, or other preliminary operations that may have been performed on the surface—the mode of planting—kinds, sizes, and number of trees planted per acre—and their relative progress and

value, as compared with plantations of a similar age and description, grown on other soils in the vicinity.

Reports to be lodged by 1st November in any year.

12. WILLOWS.

For an approved Report on the cultivation of Willows, and their most advantageous employment for basket and other industrial purposes—The Medium Gold Medal, or Five Sovereigns.

The Report must state the nature of the soil and subsoil—the time and mode of planting—the expense per acre—the best varieties—and the most profitable applications.

Reports to be lodged by 1st November 1857.

13. FOREST TREES OF RECENT INTRODUCTION.

For an approved Report on the more extended introduction of hardy, useful, or ornamental Trees, which have not hitherto been generally cultivated in Scotland—The Gold Medal.

The Report should specify, as distinctly as possible, the kind of trees introduced. The nature of the plantation should likewise be described, as to soil, exposure, shelter, and elevation above the level of the sea. The adaptation of the Trees for use or ornament, and their comparative progress, should be mentioned. Attention is directed to the introduction into use of any tree as a nurse in young plantations, which, by growing rapidly for several years, and attaining maturity when at the height of 20 or 25 feet, might realize the advantages and avoid the evils of thick planting.

Reports to be lodged by 1st November in any year.

14. IMPORTATION OF SEEDS.

To the person who shall send to the Society seeds capable of germination, either of new or recently-introduced Coniferæ, or of the rarer kinds of forest trees—The Medium Gold Medal.

Before the Premium is awarded, the number of Seedling Plants of each species raised by the Society shall not have been less than 50. Seeds of Coniferæ may be sent home in the cones, wrapped in brown paper, packed in a box, to be kept in a cool, airy part of the cabin, but on no account in the hold, nor in close tin cases. Hasty and severe heating in extracting seeds from the cone should be carefully avoided. Seeds of Hardwood may be packed in brown

paper, or in sphagnum (moss), or they may be mixed with soil and placed in strong boxes.

Seeds may be forwarded at any time.

As some of the experiments suggested in the foregoing section require to be conducted for several years before definite results regarding every particular can be arrived at, occasional communications, detailing facts of importance, will be received and acknowledged by honorary rewards.

SECTION 3. LAND IMPROVEMENTS.

1. GENERAL IMPROVEMENT OF ESTATES.

To the Proprietor who shall report the most judicious, successful, and extensive improvement on an Estate—The Gold Medal, or Ten Sovereigns.

The merits of the Report will not be determined so much by the mere extent of the improvements as by their character, and relation to the size of the property. The improvements may comprise reclaiming, draining, inclosing, planting, road-making, building, and all other operations proper to landed estates. The period within which the operations may have been conducted is not limited, except that it must not exceed the term of the Reporter's proprietorship.

Reports to be lodged by 1st May in any year.

2. RECLAMATION OF WASTE LAND BY TILLAGE.

1. For an approved Report by a Proprietor or Tenant of the reclaiming, within the six preceding years, of not less than fifty acres of Waste Land—The Gold Medal, or Ten Sovereigns.

2. For an approved Report by a Tenant of the reclaiming within the four preceding years, of not less than twenty acres of Waste Land—The Medium Gold Medal, or Five Sovereigns.

3. For a similar Report by a Tenant of the reclaiming of not less than ten acres—The Silver Medal.

The Report may comprehend such general observations on the Improvement of Waste Lands as the writer's experience may lead him to make, but must refer especially to the land reclaimed—

to the nature of the soil—the previous state and probable value of the subject—the obstacles opposed to its improvement—the mode of management adopted—and the produce and value of the crops produced. As the required extent cannot consist of different patches of land, the improvement must have relation to one subject, it must be of a profitable character, and two crops at least must have been secured before the date of the Report. *A detailed statement of the expenditure and return*, and a certified measurement of the ground, are requisite.

Reports to be lodged by 1st May in any year.

3. IMPROVEMENT OF WASTE LAND WITHOUT TILLAGE.

1. For an approved Report of the improvement, within the three preceding years, of the pasturage of not less than thirty acres, by means of Top-Dressing, Draining, or otherwise without tillage, in situations where tillage may be inexpedient—The Gold Medal, or Ten Sovereigns.

2. For an approved Report of a similar improvement of not less than ten acres—The Silver Medal.

Reports must state the particular mode of management adopted, the elevation and nature of the soil, its previous natural products, and the changes produced.

Reports to be lodged by 1st May in any year.

SECTION 4. AGRICULTURAL MACHINERY.

1. INVENTION OR IMPROVEMENT OF IMPLEMENTS OF HUSBANDRY.

For approved Reports of such inventions or improvements, by the Reporters, of any Agricultural Implement or Machine as shall be deemed by the Society of public utility—Medals or Sums not exceeding, in all, Fifty Sovereigns.

Reports may be lodged with the Secretary at any time, and should be accompanied by drawings and descriptions of the implement or machine, and, if necessary, by a model.

2. BEST CONSTRUCTION OF PLOUGH.

For an approved Report on different descriptions of Ploughs for different purposes—The Gold Medal, or Ten Sovereigns.

The attention of Competitors is particularly called to the importance of obtaining increase of depth with the least possible increase of draught. The Reporter should consider the merits of Swing Ploughs, as compared with English Wheel Ploughs; and the comparative advantages of the Scotch Ploughs, which give a high crested shoulder, and which give a rectangular shoulder. The best description of Subsoil and Trench Ploughs should also be adverted to.

Reports to be lodged by 1st November 1857.

3. BEST CONSTRUCTION OF HARROWS.

For an approved Report on the best construction of Harrows for different soils, calculated to produce, at regulated depths, the greatest division of the soil, with the least expenditure of power—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1857.

4. THRASHING MACHINES.

For an approved Report and description of an improved Thrashing Machine, in all its details. The Report must be accompanied with Drawings of the arrangements—Twenty Sovereigns.

Reports to be lodged by 1st November 1857.

5. SCOTCH AND ENGLISH THRASHING MACHINES.

For an approved Report on the comparative merits of the best Scotch and the best English Machines with high speed drums—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1857.

6. WINNOWING MACHINE.

For an approved Report of any useful Improvements on the Winnowing Machine, more particularly such as tend to increase the efficiency of the Fan, and reduce the dimensions of the Machine, without detracting from its efficiency—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1857.

7. SUBSTITUTE FOR WINNOWING MACHINE.

For an approved Report of any useful Machine qualified to dress grain more effectually than the Winnowing Machine now in use—The Gold Medal, or Ten Sovereigns.

Reports to be lodged by 1st November 1857.

8. POTATO LIFTER.

For an approved Report and description of an Implement calculated to lift Potatoes more expeditiously and economically than the Graip, and more efficiently than the Common Plough—The Medium Gold Medal, or Five Sovereigns.

Reports to be lodged by 1st November 1857.

9. WHIN BRUISER, WITH ATTACHMENT.

For an approved Report of a Machine qualified to bruise, and to cut Furze or Whins, and capable of attachment to the Thrashing Machine, or other motive power of the farm—The Medium Gold Medal, or Five Sovereigns.

Reports to be lodged by 1st November 1857.

10. REAPING MACHINES.

For the Reaping Machine which, upon trial, shall be found superior in efficiency, economy, and simplicity to any of the Reapers now before the public—Fifty Sovereigns.

As the object of this Premium is to bring out a Machine of new and superior construction, it will be understood that no mere alteration on the details of an existing one will qualify it for Competition. Competitors must enter their Machines with the Secretary not later than the 18th of June; they must exhibit them at the Glasgow Show, on the 3d, 4th, 5th, 6th, and 7th of August; and thereafter work them at such place in the Glasgow district, at such time during harvest, and subject to such regulations as may be fixed by the Directors.

11. PLOUGHING BY POWER.

For the practical application of Steam or Water Power to the Ploughing or Digging of land—Two Hundred Sovereigns.

The merits of the invention will be tested by its general applicability, by the character of its work, and by its saving in time, labour, and outlay, as compared with horse power, The Inventor must be prepared to deliver his machine at Stirling by the 1st of October, and to put it in practical operation on such farm in the neighbourhood of that town, and to work it for such a period, and under such regulations, as the Directors may determine, the object being to test its capabilities by continued work, and not by a mere show trial.

Intimation of intention to compete must be lodged with the Secretary by the 1st of September.

CLASS II.

DISTRICT COMPETITIONS.

SECTION 1. CATTLE.

DISTRICTS.

1. *The District connected with the Inverness Farmers' Club.*
2. *The Districts of Ythanside and Formartine.*
3. *The County of Kincardine.*
4. *The District in connexion with the Garioch Farmers' Club.*
5. *The District of Strathspey.*
6. *The Islands of Orkney.*
7. *The Island of Lews, including the District of Harris.*
8. *The Stewartry of Kirkcudbright.*
9. *The Middle Ward of Lanarkshire to the South of the Clyde, and the Parish of Lesmahagow.*

1. For the best Bull, of any pure Breed, not exceeding eight years old, belonging to a Proprietor or Factor—The Silver Medal.

2. For the best Bull, of any pure Breed, calved before 1st January 1855, and not exceeding eight years old, belonging to a Tenant or Proprietor farming the whole of his own lands—Eight Sovereigns.

3. For the second best—Four Sovereigns.

4. For the best Bull of any pure Breed, calved after 1st January 1855, belonging to a Tenant or Proprietor farming the whole of his own lands—Five Sovereigns.

5. For the best pair of Heifers, of any pure breed, of two years old (if Highland Breed, three years), belonging to a Tenant or a Proprietor farming the whole of his own lands—Five Sovereigns.

6. For the second best—Three Sovereigns.

The Society's Premiums are granted to each District for three alternate years, on condition that the Districts shall, in the two intermediate years, continue the competitions by offering a sum not less than one-half of that given by the Society.

At the Intermediate Competitions, a Silver Medal will be placed at the disposal of the Committee to be awarded to the best lot exhibited.

In 1857,

Nos. 1 and 2 are in competition for the last year.
Nos. 3, 4, 5, and 6, for the second year.

Nos. 7, 8, and 9, compete for local premiums.

Conveners of Committees.

For the First District—Henry W. White of Monar.
For the Second District—John Leith Ross of Arnage.
For the Third District—Sir John Stuart Forbes of Pitsligo, Bart.
For the Fourth District—Sir James Dalrymple Elphinstone, Bart.
For the Fifth District—Cluny Macpherson.
For the Sixth District—Robert Scarth of Binscarth.
For the Seventh District—Sir James Matheson of Lews, Bart., M.P.
For the Eighth District—Wellwood Maxwell of Munshes.
For the Ninth District—Pat. Graham Barns of Limekilns.

RULES OF COMPETITION.

1. The members of the Society connected with the respective Districts are appointed Committees of superintendence for regulating the Competitions; three members to be a quorum.

2. The Convener of each District will summon a meeting of Committee, for the purpose of determining the time and place of Competition, the nomination of Judges, and other preliminary arrangements. The time and place will be publicly intimated by Conveners, in such a manner as may appear to them most effectual.

3. The Competitions must take place between the 1st of May and the 1st of November. The animals exhibited must belong to one of the pure Breeds —Short-horn—Ayrshire—Polled (Galloway, Angus, or Aberdeen)—Highland. The Bull may be of one Breed, and the Heifers of another. The Committee will select the Breed, and specify it in the returns.

4. Stock of an inferior description, or which does not fall within the prescribed regulations, shall not be placed for Competition. The Premiums shall not be divided. No Money Premium shall be adjudged unless there are three Lots exhibited, and not more than one-half unless there are six. A Competitor may exhibit two Lots in each Class. For the Medal, two Lots authorize an award.

5. An animal which has gained the Society's first Premium at a previous District or General Show is inadmissable, except for the Medal; and one which has gained a Second Money Premium can only thereafter compete for the First. The same animal cannot be entered for the Medal and the Money.

6. A Tenant may compete with Proprietors and Factors for the Medal with a Bull which has gained the first Money Premium at a previous show. When there is any doubt as to whether a Competitor should be ranked as a Proprietor or a Tenant, the point is left to the decision of the Local Committee. Factors can only compete for the Medal.

7. A Bull, the property of two or more Tenants, may compete, although the Exhibitors may not be joint Tenants. Bulls not belonging to the District may compete, provided they are left within it for service.

8. Bulls for which the Money Premiums are awarded must serve in the District at least one season; and the rate of service may be fixed by the Committee.

9. Blank Reports and Returns will be furnished to the Conveners of the different Districts. These must, in all details, be completed and lodged with the Secretary on or before the 15th of November next.

10. A Report of the Competition and Premiums awarded at the *intermediate* Local Shows, in the several Districts, signed by a member of the Society, must be transmitted to the Secretary on or before the 15th of November in each year, otherwise the Society's grant shall terminate.

11. It is to be distinctly understood, that in no instance does any claim lie against the Society for expenses attending a Show of Stock, beyond the amount of the Premiums offered; and that all Premiums not applied for within two years from the term of payment (10th February 1858) shall be forfeited.

SECTION 2. DRAUGHT HORSES.

DISTRICTS.

1. *The District in connexion with the Lauder Agricultural Society.*

CONVENER—The Hon. Sir Anthony Maitland.

2. *The District in connexion with the Spey, Avon, and Fiddoch-side Farming Society.*

CONVENER—Wm. Grant, Younger of Elchies.

3. *The District of Kintyre.*

CONVENER—John Lorne Stewart of Coll.

Forty Sovereigns, of which twenty are contributed by the Local Associations, will be awarded as follows:—

1. For the best Stallion, for agricultural purposes, not under three years and nine months, and not above twelve years old—Twenty-five Sovereigns.

2. For the best Brood Mare, for agricultural purposes—Ten Sovereigns.

3. For the best Filly, foaled after 1st January 1855—Five Sovereigns.

RULES OF COMPETITION.

1. The Members of the Society in the District are appointed a Committee of Superintendence, as in No. 1 of the Regulations for the Cattle Competitions; and they will be convened in the same manner, and for purposes similar to those indicated in the said Regulations.

2. The time and place of Competition for the respective Districts will be fixed by the Convener, with the concurrence of the Committee, and published by him in due time, and in such manner as shall be thought most effectual for the information of those interested.

3. If fewer than three animals be exhibited in any class, half the Premium only can be awarded. The Regulations for Cattle Shows, regarding previous intimation to the Committee and Competitors—the power of the Committee to exclude stock, if of inferior character—extra expenses—the period within which Premiums must be applied for—and the manner in which the Reports are to be certified and transmitted to the Society—are severally applicable to the Premiums for Horses. Evidence must be produced that the Prize Stallions have had produce. Mares must have foals at their feet, or be entered as being in foal; in the latter case, payment of the Premium will be deferred till certificate of birth.

ENTIRE COLTS.

NOTE.—The Society being anxious to promote the improvement of Draught Horses by encouraging the rearing of entire Colts, Stallion premiums are limited to a period of two years, and followed by premiums for other two years within the same District for entire Colts.

DISTRICTS.

1. *The District of Mid-Calder, with the Parishes of Livingston, Uphall, and Kirkliston, in Linlithgowshire.*

CONVENER—Sir Alexander C. Gibson Maitland, Bart.

2. *The District in connexion with the Strathendrick Farmers' Society.*

CONVENER—John Buchanan of Carbeth.

3. *The District in connexion with the Forfarshire Agricultural Society.*

CONVENERS—Lord Panmure, and Sir John Ogilvy, Bart.

1. For the best entire Colt, for agricultural purposes, foaled after 1st January 1855—Six Sovereigns.
2. For the best entire Colt, for agricultural purposes, foaled after 1st January 1856—Four Sovereigns.

If fewer than three animals are exhibited in either class, only half the Premium can be awarded. The other regulations are generally applicable.

SECTION 3. SHEEP.

1. LEICESTER BREED.

DISTRICTS.

1. *The County of Banff, and Turriff District.*
2. *The District in connexion with the Border and Union Agricultural Society.*
3. *The District of Easter Ross.*
4. *The County of Ayr.*

1. For the best Tup of any age, belonging to a Proprietor, or Factor—The Silver Medal.
2. For the best Tup of any age—Five Sovereigns.
3. For the best two Shearling Tups—Five Sovereigns.
4. For the best Pen of five Ewes, not less than two Shear—Five Sovereigns.
5. For the best Pen of five Gimmers or Shearling Ewes—Four Sovereigns.

The Money Premiums are restricted to Tenants, and Proprietors farming the whole of their own Lands.

In 1857—

No. 1 is in competition for the last year.
Nos. 2 and 3 for the second year.

No. 4 competes for Local Premiums.

Conveners of Committees.

For the First District—Alexander Morison of Bognie.
For the Second District—Lord Polwarth.
For the Third District—Wm. H. Murray of Geanies.
For the Fourth District—James Campbell of Craigie.

2. CHEVIOT BREED.

DISTRICTS.

1. *The County of Sutherland and the Parishes of Reay and Latheron in Caithness.*
2. *The County of Roxburgh.*
3. *The Island of Skye.*
4. *That part of Argyllshire attached to the Sheriffship of Tobermory, with the Districts of Kingairloch, Ardgour, and Ardnamurchan.*

1. For the best Tup of any age, belonging to a Proprietor or Factor—The Silver Medal.
2. For the best Tup of any age—Five Sovereigns.
3. For the best two Shearling Tups—Five Sovereigns.
4. For the best Pen of five Ewes, not less than Two Shear—Five Sovereigns.
5. For the best Pen of five Gimmers or Shearling Ewes—Four Sovereigns.

The Money Premiums are restricted to Tenants, and Proprietors farming the whole of their own Lands.

In 1857—

Nos. 1, 2, and 3 are in competition for the last year.

No. 4 competes for Local Premiums.

Conveners of Committees.

For the First District—George Dempster of Skibo.
For the Second District—John Ord of Muirhouselaw.
For the Third District—Lord Macdonald, or his Factor.
For the Fourth District—William Robertson of Kinlochmoidart.

3. BLACK-FACED BREED.

DISTRICTS.

1. *The District in connexion with the Lochaber Agricultural Society.*
2. *The County of Wigtown.*
3. *The District of Atholl, including Glenerochy and Strathtummel, and Strathardle, Blackwater, and Glenshee, above the Bridge of Calley.*
4. *The Districts of Currie, Penicuik, and Biggar.*
5. *The Districts of Breadalbane and Weem.*

1. For the best Tup of any age, belonging to a Proprietor or Factor—The Silver Medal.
2. For the best Tup of any age—Five Sovereigns.
3. For the best two Shearling Tups—Five Sovereigns.
4. For the best pen of five Ewes, not less than Two Shear—Four Sovereigns.
5. For the best pen of five Gimmers or Shearling Ewes—Four Sovereigns.

The Money Premiums are restricted to Tenants and Proprietors farming the whole of their own Lands.

In 1857—

Nos. 1 and 2 are in competition for the second year.
No. 3 for the first year.

Nos. 4 and 5 compete for Local Premiums.

Conveners of Committees.

For the First District—Sir Duncan Cameron of Fassfern, Bart.
For the Second District—Sir Andrew Agnew of Lochnaw, Bart., M.P.
For the Third District—The Duke of Athole.
For the Fourth District—Sir George Clerk of Penicuik, Bart.
For the Fifth District—James F. Wyllie, Bolfracks.

RULES OF COMPETITION.

1. The Members of the Society in the several Districts are appointed Committees of Superintendence, as in Nos. 1 and 2 of the Regulations for Cattle Competitions, and they shall be convened by their respective Conveners on or before the 20th of May, in the same manner and for the same purposes as specified in these Regulations.

2. The Competition shall take place between the 1st of June and the 1st of November, and the time and place must be publicly intimated by each Convener within his District.

3. Tups shall have served the usual number of Ewes for at least three weeks during the previous season. All prize Tups must serve within the Districts during the previous season. The Competitions are open to Tups not belonging to the Districts, provided they are left to serve in them. Ewes must have reared Lambs during the season. Ewes and Gimmers must be taken from regular breeding hirsels.

4. The Premiums shall not be divided. No Money Premium shall be adjudged unless there are three Lots exhibited, and only one-half if there are not six Lots. Each Competitor may show two Lots. For the Medal two Lots authorize an award. The other Regulations for Cattle Competitions—in regard to the placing of Stock—the exclusion of Animals which have gained Premiums at previous shows—the right of a Tenant, under certain circumstances, to compete for the Medal—the Regulation as to expenses—the period within which Premiums must be applied for—and the manner in which the Reports must be certified and transmitted—are applicable to the Premiums for Sheep.

5. The Society gives these Premiums in alternate years for three Competitions in each District, if, during the intervening years, Premiums are awarded by the District to an amount not less than one-half of the Society's Premiums, and for the same description of Stock. Reports of these intermediate Competitions must be lodged by the 15th of November, or the Society's grant shall terminate.

6. Blank Reports, and Returns of Competitions, will be furnished to the Conveners of Districts. These must be accurately filled up in all details, signed by the Convener, and transmitted to the Secretary by the 15th of November.

4. SHEARING SHEEP.

The Silver Medal will be given to the best Sheep-shearer in each of the Districts in which the Premiums for sheep are in operation.

CONDITIONS.

1. Money Premiums must be awarded by the district at each competition, to the amount of not less than £2.

2. The District Convener will fix the time and place of Competition, and make all necessary arrangements.

3. The Medal shall not be awarded unless there are three Competitors, and it shall always accompany the highest Money Premium; if two or more Lots appear to be equally well executed, preference should be given to that executed within the shortest time.

4. The Conveners shall report the particulars of the Competition and the award of the Judges to the Society, along with the Report of the Sheep Premiums in the District.

Section 4. SWINE.

1. *Lower Annandale and Nithsdale.*

Convener—Colonel Graham of Mossknow.

2. *The District of Formartine.*

Convener—Rear-Admiral the Hon. William Gordon.

3. *The County of Mid-Lothian.*

Convener—R. B. Wardlaw Ramsay of Whitehill.

1. For the best Boar belonging to a Proprietor or Factor—The Silver Medal.
2. For the best Boar—Four Sovereigns.
3. For the second best—Two Sovereigns.
4. For the best Breeding Sow—Three Sovereigns.
5. For the second best—One Sovereign.

The Money Premiums are restricted to Tenants, and Proprietors farming the whole of their own Lands.

The Regulations for Cattle Competitions, pages 36 and 37, are to be held as applicable to the Premiums for Swine; and the Convener and Committee of the Society's Members in the Districts are accordingly referred to them.

Blank Reports, and Returns of Competitions, will be furnished to the Conveners of Districts. These must be accurately filled up in all details, signed by the Convener, and transmitted to the Secretary by the 15th of November.

CLASS III.

DAIRY PRODUCE.

DISTRICTS.

1. *The District in connexion with the Pitsligo and Turriff Farmers' Clubs.*

Convener—Sir John Stuart Forbes of Pitsligo, Bart

2. *The Rhins District of Wigtownshire.*

CONVENER—Viscount Dalrymple.

BUTTER.

1. For the best sample of cured Butter (not less than 14 lbs.) belonging to a Proprietor or Factor—The Silver Medal.

2. For the best sample of cured Butter (not less than 14 lbs.) belonging to a Tenant, or Proprietor farming the whole of his own lands—Three Sovereigns.

3. For the second best—Two Sovereigns.

CHEESE.

4. For the best couple of Sweet Milk Cheeses belonging to a Proprietor or Factor—The Silver Medal.

5. For the best couple of Sweet Milk Cheeses belonging to a Tenant, or Proprietor farming the whole of his own lands—Three Sovereigns.

6. For the second best—Two Sovereigns.

CONDITIONS.

1. The Members of the Society, resident within the Districts, are appointed Committees of superintendence, for the purposes expressed in the Regulations for Cattle competitions.

2. Competitors must certify that the Butter and Cheese exhibited by them are average specimens of the produce of their Dairies in 1857; and that the quantity produced during the season has not been less than 1 cwt. of butter, or 2 cwt. of cheese. Cheeses may be made either in the Scotch or English mode, provided they be of full milk only, and without any admixture of cream. The Committees shall fix such general regulations as they may consider proper—and, in particular, the time and place of competition. In the event of two or more competing Lots being deemed equal in quality, the Premium will be awarded to the Competitor who shall have made the larger quantity. The successful Competitors, before receiving the Premiums, are required to transmit to the Secretary a detailed Report of the whole process followed by them in the manufacture of their Butter or Cheese.

3. Reports of the award of the Premiums to be lodged with the Secretary on or before the 15th November 1857.

CLASS IV.

CROPS AND CULTURE.

1. SEEDS.

The Society, with a view of aiding Local Associations in the improvement of the different Grains, Grasses, Roots, &c., offers the Silver Medal to the growers of the best Seeds, for which Premiums shall have been awarded in the following Districts :—

1. District of BUCHAN: Convener, James Ferguson of Kinmundy.
    1. Any variety of Oats.
    2. Any variety of Barley.
    3. Perennial Rye Grass.

2. District of WESTER ROSS: Convener, Sir James J. R. Mackenzie of Scatwell, Bart.
    1. Any variety of White Wheat.
    2. Any variety of Barley.
    3. Any variety of Oats.
    4. Perennial Rye Grass.

3. County of INVERNESS: Convener, Arthur Forbes of Culloden.
    1. Any variety of White Wheat.
    2. Any variety of Barley.
    3. Any variety of Oats.
    4. Perennial Rye Grass.

4. County of NAIRN: Convener, James C. Brodie of Lethen.
    1. Any variety of Wheat.
    2. Any variety of Barley.
    3. Any variety of Oats.
    4. Perennial Rye Grass.

5. County of BANFF, and Turriff District: Convener, Alexander Morison of Bognie.
    1. Any variety of Early Oats.

2. Chevalier Barley.
3. Any other variety of Barley.
4. Perennial Rye Grass.

6. County of ELGIN: Convener, C. L. Cumming Bruce of Roseisle, M.P.

1. Any variety of Wheat.
2. Any variety of Barley.
3. Any variety of Oats.
4. Perennial Rye Grass.

CONDITIONS.

1. In each District, the Convener will fix the time and place of Competition, appoint the Judges, and make all other necessary arrangements, in concurrence with the other Members of the Society, and the Local Association of the District. Conveners will be furnished with blank Schedules for returning the awards.

2. The quantity shown in Competition by each Grower must not be less than three quarters of each variety of grain, two quarters of Beans, Pease, Vetches, or Grass-Seeds, and half a Ton of Potatoes. To authorize the award of the Medal, there must at least be two Competitors. The first premium awarded by the District shall not be less than £1, for each kind of grain for which a medal is claimed.

3. The Judges shall be guided in their awards—*1st*, By the purity of the Seed; *2d*, By its freeness from extraneous seeds; And, *3d*, Where there is an equality in these respects, by the weight. Competitors must have previously certified that the Grain, Grasses, Beans, &c., exhibited, are fair average specimens of what have been thrashed, and that the lots have in no way been picked or sorted.

4. Successful Competitors must immediately transmit to the Society's Museum, George IV. Bridge, Edinburgh, free of expense, a sample of the Seed. If it is Grain or Grass, the quantity must not be less than two quarts.

5. The Returns must show, as accurately as possible, the produce per imperial acre, also the altitude, exposure, and nature of the soil on which the crops were raised, together with the dates of sowing and reaping, and, in the case of Grain or Grass-Seed, the weight per bushel. The varieties for which Premiums have been given must be named. Reports of the several Competitions must be lodged by the 15th of November.

6. The Medals will be continued in each District for five consecutive years. Applications from other Districts must be lodged with the Secretary of the Society by 1st November next.

2. GREEN CROPS ON SMALL POSSESSIONS.

With the view of improving the cultivation of small possessions, by the introduction of Green Crops, the following premiums, one-

half of which is contributed by the respective Districts, will be awarded:—

For the best Green Crop.—Three Sovereigns.
For the second best do.—Two-and-a-half Sovereigns.
For the third best do.—One-and-a-half Sovereign.
For the fourth best do.—One Sovereign.

DISTRICTS.

1. The Parishes of KENMORE and KILLIN, including the portion of the Parish of WEEM on Loch Tay.—Convener, James F. Wyllie, Bolfracks.
2. The Island of SKYE.—Convener, Lord Macdonald, or his Factor.
3. The *Quoad Sacra* Parish of NEW PITSLIGO.—Convener, Sir John Stuart Forbes of Pitsligo, Bart.
4. The Mainland, or any of the Islands of Orkney.—Conveners, David Balfour of Balfour, and J. G. Heddle of Melsetter.

CONDITIONS.

1. The Competition to be limited to Tenants occupying not more than 40 acres of land, and to be under the charge of the Society's Members in the different Districts.

2. At least one-half of the Green Crop to be Turnips, and that portion which is in Green Crop in 1857 should be sown out, with sufficient quantities of Clovers and Rye Grass, with the White Crop in 1858.

3. Should there be only one Competitor, the Committee may allow him such portion of one of the Premiums as they may think merited. The Committee may withhold all or any portion of the Premiums.

4. Inspectors, to be fixed by the respective Committees, shall decide the Premiums.

5. The awards to be intimated to the Secretary of the Society on or before the 15th of November in each year, and Conveners are particularly requested to state in their Reports the proportion of each Lot cropped, as above mentioned, and to offer any suggestions which they may consider of importance.

3. PLOUGHING COMPETITIONS.

The Silver Medal will be given to the Winner of the first Premium at Ploughing Competitions, where there are fifteen Ploughs, and Premiums to the amount of Three Sovereigns. To authorize the issue of the Medal, a Report, in the following terms, must be made to the Secretary, within one month of the date of the Competition, by a Member of the Society:—

I of Member of the Highland

and Agricultural Society, hereby certify, that I attended a Ploughing competition at on the when ploughs competed; of land was assigned to each, and hours were allowed for the execution of the work. The sum of £ was awarded in the following proportions, viz.:

[Here enumerate the names and designations of successful Competitors.]

A Ploughman is to receive no assistance, and his work is in no respect to be touched by others.

In estimating the work of Competitors, attention should be directed to its sufficiency below, as well as to its neatness above the surface.

On land of average tenacity, the rate of ploughing should not be less than will turn over an imperial acre in ten hours.

A Ploughman cannot carry more than one Medal in the same year.

A Member can only report one Match in the same year.

4. REAPING MACHINES.

With the view of encouraging the management of Reaping Machines, the Silver Medal will be given to the Servant found most expert in any parish, when not less than Six Machines have been worked, and Premiums to the amount of Two Sovereigns are awarded. Reports must be lodged with the Secretary by a Committee who have inspected the work, not later than the 1st of October.

5. MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

The Society being anxious to co-operate with Local Associations in their efforts to promote improvement, will give a limited number of Silver Medals annually, in addition to the Money Premiums which may be awarded to Tenants by such Associations—

1. STOCK.—To any Local Society, not on the list of District Competitions, awarding for Pure Breeds of Stock premiums not less than £10, and reporting their Show to the Secretary.

Applied for by the Forbes and Fordyce Agricultural Association—Convener, Sir John Stuart Forbes of Pitsligo, Bart.

The Peeblesshire Agricultural Association.

The Bute Farmers' Society—Convener, Thomas Gibson of Spittal, M.D.

2. For the best managed FARM.

Applied for by the Nairnshire Farming Society—Convener, James Campbell Brodie of Lethen.

The Inverness Farmers' Society.—Convener, Arthur Forbes of Culloden.

The Carrick Farmers' Society.—Convener, P. W. Kennedy of Drumellan.

The East Kilpatrick Society.—Convener, Archibald Campbell Colquhoun, yr. of Killermont.

3. For the best managed DAIRY.

Applied for by the Bute Farmers' Society—Convener, Thos. Gibson of Spittal, M.D.

4. For the best managed GREEN CROP.

Applied for by the Ythanside Farmers' Club.—Convener, Charles Napier Gordon of Eslemont.

The Bute Farmers' Society.—Convener, Thomas Gibson of Spittal, M.D.

The Lower Annandale Agricultural Society.—Convener, Colonel Graham of Mossknow.

The Inverness Farmers' Society.—Convener, Arthur Forbes of Culloden.

The District of Breadalbane—Convener, James F. Wyllie, Bolfracks.

The Dalrymple Farmers' Society.—Convener, James Campbell of Craigie.

The East Kilpatrick Society.—Convener, Archibald Campbell Colquhoun, yr. of Killermont.

The Leochel-Cushnie Society.—Convener, Arthur Forbes, W.S.

The Clackmannan Farmers' Society.—Convener, James Johnstone of Alva, M.P.

5. For the best kept FENCES.

Applied for by the East of Berwickshire Farmers' Club.—Convener, David Milne Home of Wedderburn.

6. For the best kept DUNGHILL.

Applied for by the District of Breadalbane.—Convener, James F. Wyllie, Bolfracks.

7. To the Labourer most expert and efficient in opening and fill-

ing Drains, and otherwise executing the works necessary in thorough Draining.

Applied for by the Nairnshire Farming Society.—Convener, James Campbell Brodie of Lethen.

The Carrick Farmers' Society.—Convener, P. W. Kennedy of Drumellan.

8. To the Labourer most expert in Cutting Hedges.

Applied for by the East of Berwickshire Farmers' Club.—Convener, David Milne Home of Wedderburn.

The Medals to be issued will be limited to ten in each class. Reports of the several Competitions must be lodged by the 1st of October, and applications for 1858 must be lodged by 1st November next, accompanied with a guarantee, that, in addition to the Medal, Premiums of not less than £2 will be given by the District applying, except in No. 1, where £10 is required.

CLASS V.

COTTAGES AND GARDENS.

The following Premiums are offered for competition in the Parishes after mentioned. The Medals and one-half of the Premiums are given by the Society, and the other half is contributed by the respective Parishes.

COTTAGES.

1. For the best kept Cottage in each Parish—One Pound Five hillings; and where there are four Competitors—The Silver Medal.
2. For the second best—One Pound.
3. For the third best—Fifteen Shillings.

GARDENS.

1. For the best kept Cottage Garden in each Parish—One Pound

Five Shillings; and where there are four Competitors—The Silver Medal.

2. For the second best—One Pound.
3. For the third best—Fifteen Shillings.

Lanarkshire.

LAMINGTON—Convener, Alexander Baillie Cochrane of Lamington, M.P.
LESMAHAGOW.—Convener, W. E. Hope Vere of Blackwood.
COVINGTON.—Convener, Sir Wyndham Carmichael Anstruther, Bart.

Orkney.

SHAPINSHAY.—Convener, David Balfour of Balfour.

Perthshire.

ST MARTINS.—Convener, William Macdonald Macdonald of St Martins.

Wigtownshire.

KIRKCOLM.—Convener, David Guthrie, Stranraer.
LESWALT.—Convener, Sir Andrew Agnew of Lochnaw, Bart., M.P.
PORT-PATRICK.—Edward Hunter Blair of Dunskey.
OLD LUCE.—Captain Dalrymple Hay, younger of Park Place.

CONDITIONS.

1. Competitions may take place in the different Parishes for Cottages and Gardens, or for either separately.

2. In either case, the occupiers of Gentlemen's Lodges and Gardeners' Houses are excluded, as well as Gentlemen's Servants occupying Cottages in the Policies, or on land in the natural possession of their masters. The inspection must be completed by the 1st of October. In making the inspection, the Conveners may take the assistance of any competent judge.

3. The annual value of each Cottage, with the ground occupied in the parish by a Competitor, shall not (except in the parish of Shapinshay) exceed £5 sterling. A Competitor who has gained a Premium in a previous year, cannot compete again for the same or a lower Premium.

4. If the Cottage is occupied by the proprietor, the roof must be in good repair; if the roof is of thatch, it must be in good repair, though in the occupation of a tenant. The interior, and the external conveniences, must be clean and orderly—the windows must be free of broken glass, clean, and affording the means of ventilation. Dunghills, and all other nuisances, must be removed from the front and gables. In awarding the Cottage Premiums, preference will be given to Competitors who, in addition to these requisites, have displayed

the greatest taste in ornamenting the exterior of their houses, and the ground in front and at the gables.

5. In estimating the claims for the Garden Premiums, the Judges should have in view—the sufficiency and neatness of the fences; the cleanness of the ground, and neatness of the walls; the quality of the crops, and general productiveness of the garden; and the choice of crops.

6. Reports stating the number of Competitors, the names of successful parties, and the nature of the exertions which have been made by them, must be transmitted by the Conveners to the Secretary on or before the 15th of October next.

Parishes desirous of these Premiums must lodge applications with the Secretary on or before the 1st November next.

MEDALS FOR COTTAGES OR GARDENS.

The Society will issue annually twelve Medals to Local Associations, or individuals, who, at their own expense, establish Premiums for Cottages or Gardens.

The Medals will be issued upon a Report by a Member of the Society in the terms required by the preceding conditions, describing the merits of the Cottages or Gardens. The Reports to be lodged with the Secretary on or before the 15th October 1857.

Applied for by The Linlithgow Agricultural Society.
Lord Kinnaird.
Mrs Douglas Baird of Closeburn.
Lanark Horticultural Society.
Eastern District of Stirling.
The Proprietors of Lundin.
The Parish of Forgue.

IMPROVING EXISTING COTTAGES.

To the Proprietor in Scotland who shall report the Improvement of the greatest number of Cottages in the years 1854, 1855, and 1856—The Gold Medal.

BUILDING NEW COTTAGES.

To the Proprietor in Scotland who shall report the erection of the greatest number of approved Cottages during the years 1853, 1854, 1855, and 1856—The Gold Medal.

CONDITIONS.

Claims for the above Premiums must be lodged with the Secretary on or before the 1st of October next, to allow an inspection to be made of the different Cottages. The inspections will be conducted by Committees of the Society's Members in the different Districts; and Reports must be transmitted by the Conveners to the Secretary on or before the 1st December.

The annual value of the Cottage or Cottages separately, with garden ground, must not exceed £5.

In estimating the claims of Competitors, the following points will be kept in view—the external appearance of the Cottages, their internal accommodation; the arrangements of the outhouses; the means of drainage and ventilation; and the expense of the building or of the alteration compared with its durability and accommodation. When the Cottages of one Competitor are superior in style and comfort to those of another, though not so numerous, the Inspectors will give them the preference, provided they amount at least to three, and have been erected at a moderate expense.

Parties competing will forward plans, specifications, and estimates, to the Society, of which, and of all information sent therewith, copies may be taken for publication, if the Society shall see fit, and the originals returned to the parties within six months, if desired.

ACCOMMODATION FOR FARM-SERVANTS.

To the Proprietor in Scotland who shall have erected on his estate the most approved Farm-buildings in reference to the proper accommodation of Farm-Servants—The Gold Medal.

Reports, Plans, and Specifications, to be lodged by the 1st of November 1857.

AGRICULTURAL MEETING

AND

GENERAL SHOW OF STOCK, POULTRY, DAIRY PRODUCE, AND IMPLEMENTS,

AT

GLASGOW,

ON THE 3D, 4TH, 5TH, 6TH, and 7TH of AUGUST, 1857.

President of the Society,

HIS GRACE THE DUKE OF HAMILTON AND BRANDON.

Chairman of the General Committee,

THE EARL OF EGLINTON AND WINTON, K.T.

Chairman of the Glasgow Committee,

THE LORD PROVOST OF GLASGOW.

The District connected with the Show comprises the Counties of Lanark, Argyll, Ayr, Bute and Arran, Dumbarton, Renfrew, and Stirling.

GENERAL ARRANGEMENTS.

MONDAY,......3d August.—Admission and Arrangement of Implements.

TUESDAY,......4th August.—Arrangement and Inspection of Implements.

WEDNESDAY, 5th August.—Trial and Exhibition of Implements, and of Poultry and Dairy Produce.

THURSDAY,....6th August.—General Exhibition of Stock, Implements, &c. &c., and Public Banquet.

FRIDAY,........7th August.—Exhibition of Prize Stock, Implements, &c.

The Competition is open to Exhibitors from all parts of the Kingdom.

No Certificates of Entry can be received after Thursday the 18th of June.

Members of the Society, and Candidates for admission, have access to the Show-Yard without payment, and are exempted from Entry-Money on Stock, &c., in terms of Regulation No. 1.

CLASS I.—CATTLE.

AYRSHIRE.

SECTION

1 For the best Bull calved before 1st January 1855—Twenty Sovereigns.
For the second best—Ten Sovereigns.
For the third best—The Bronze Medal.
To the breeder of the best Bull—The Silver Medal.

2 For the best Bull calved after 1st January 1855—Twenty Sovereigns.
For the second best—Ten Sovereigns.
For the third best—The Bronze Medal.

3 For the best Bull calved after 1st January 1856—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

4 For the best Cow in Milk calved before 1st January 1854—Fifteen Sovereigns.
For the second best—Eight Sovereigns.
For the third best—The Bronze Medal.
To the breeder of the best Cow—The Silver Medal.

5 For the best Cow in Milk calved after 1st January 1854—Fifteen Sovereigns.
For the second best—Eight Sovereigns.
For the third best—The Bronze Medal.
To the breeder of the best Cow—The Silver Medal.

6 For the best Cow in Calf of any age—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.
To the breeder of the best Cow—The Silver Medal.

7 For the best Heifer calved after 1st January 1855—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

SECTION

8 For the best Heifer calved after 1st January 1856—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

SHORT-HORN.

9 For the best Bull calved before 1st January 1855—Twenty Sovereigns.
For the second best—Ten Sovereigns.
For the third best—The Bronze Medal.
To the breeder of the best Bull—The Silver Medal.

10 For the best Bull calved after 1st January 1855—Twenty Sovereigns.
For the second best—Ten Sovereigns.
For the third best—The Bronze Medal.

11 For the best Bull calved after 1st January 1856—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

12 For the best Cow of any age—Fifteen Sovereigns.
For the second best—Eight Sovereigns.
For the third best—The Bronze Medal.

13 For the best Heifer calved after 1st January 1855—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

14 For the best Heifer calved after 1st January 1856—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

POLLED ANGUS OR ABERDEEN.

15 For the best Bull calved before 1st January 1855—Twenty Sovereigns.
For the second best—Ten Sovereigns.
For the third best—The Bronze Medal.
To the breeder of the best Bull—The Silver Medal.

16 For the best Bull calved after 1st January 1855—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

SECTION

17 For the best Cow of any age—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

18 For the best Heifer calved after 1st January 1855—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

POLLED GALLOWAY.

19 For the best Bull calved before 1st January 1855—Twenty Sovereigns.
For the second best—Ten Sovereigns.
For the third best—The Bronze Medal.
To the breeder of the best Bull—The Silver Medal.

20 For the best Bull calved after 1st January 1855—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

21 For the best Cow of any age—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

22 For the best Heifer calved after 1st January 1855—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

HIGHLAND.

23 For the best Bull calved before 1st January 1855—Twenty Sovereigns.
For the second best—Ten Sovereigns.
For the third best—The Bronze Medal.
To the breeder of the best Bull—The Silver Medal.

24 For the best Bull calved after 1st January 1855—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

25 For the best Cow of any age—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

26 For the best Heifer calved after 1st January 1854—Ten Sovereigns.

SECTION

For the second best Heifer calved after 1st January 1854—Five Sovereigns.

For the third best—The Bronze Medal.

27 For the best Heifer calved after 1st January 1855—Eight Sovereigns.

For the second best—Four Sovereigns.

For the third best—The Bronze Medal.

CLASS II.—HORSES,

FOR AGRICULTURAL PURPOSES.

SECTION

1 For the best Stallion foaled before 1st January 1854—Thirty Sovereigns.

For the second best—Fifteen Sovereigns.

For the third best—The Bronze Medal.

To the breeder of the best Stallion—The Silver Medal.

2 For the best Entire Colt foaled after 1st January 1854—Twenty Sovereigns.

For the second best—Ten Sovereigns.

For the third best—The Bronze Medal.

3 For the best Entire Colt foaled after 1st January 1855—Fifteen Sovereigns.

For the second best—Eight Sovereigns.

For the third best—The Bronze Medal.

4 For the best Entire Colt foaled after 1st January 1856—Ten Sovereigns.

For the second best—Five Sovereigns.

For the third best—The Bronze Medal.

5 For the best Mare (with foal) foaled before 1st January 1854—Twenty Sovereigns.

For the second best—Ten Sovereigns.

For the third best—The Bronze Medal.

6 For the best Mare (in foal) foaled before 1st January 1854—Fifteen Sovereigns.

For the second best—Eight Sovereigns.

For the third best—The Bronze Medal.

7 For the best Filly foaled after 1st January 1854—Ten Sovereigns.

For the second best—Five Sovereigns.

For the third best—The Bronze Medal.

SECTION

8 For the best Filly foaled after 1st January 1855—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

9 For the best Filly foaled after 1st January 1856—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—The Bronze Medal.

EXTRA.

10 For the best Draught Horse or Mare in Harness—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

11 For the best Horse or Mare, not exceeding 15 hands high, suitable for milk carts of heavy draught—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

12 For the best Horse or Mare, not exceeding 14½ hands high, suitable for milk carts of light draught—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

CLASS III.—SHEEP.

LEICESTER.

SECTION

1 For the best Tup not more than four shear—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

2 For the best Dinmont or Shearling Tup—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

3 For the best pen of Five Ewes not more than four shear—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

SECTION

4 For the best pen of five Shearling Ewes or Gimmers—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

CHEVIOT.

5 For the best Tup not more than four shear—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

6 For the best Dinmont or Shearling Tup—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

7 For the best pen of five Ewes not more than four shear—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

8 For the best pen of five Shearling Ewes or Gimmers—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

BLACKFACED.

9 For the best Tup not more than four shear—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

10 For the best Dinmont or Shearling Tup—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

11 For the best pen of five Ewes not more than four shear—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

12 For the best pen of five Shearling Ewes or Gimmers—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

SOUTHDOWN.

13 For the best Tup not more than four shear—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

SECTION

14 For the best Dinmont or Shearling Tup—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

15 For the best pen of five Ewes not more than four shear—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

16 For the best pen of five Shearling Ewes or Gimmers—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

LONG-WOOLLED SHEEP OTHER THAN LEICESTER.

17 For the best Tup not more than four shear—Ten Sovereigns.
For the second best—Five Sovereigns.
For the third best—The Bronze Medal.

18 For the best pen of five Ewes not more than four shear—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

CLASS IV.—SWINE.

SECTION

1 For the best Boar, large breed—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

2 For the best Boar, small breed—Eight Sovereigns.
For the second best—Four Sovereigns.
For the third best—The Bronze Medal.

3 For the best Sow, large breed—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—The Bronze Medal.

4 For the best Sow, small breed—Six Sovereigns.
For the second best—Three Sovereigns.
For the third best—The Bronze Medal.

5 For the best pen of three pigs not exceeding 8 months old—Four Sovereigns.
For the second best—Two Sovereigns.
For the third best—The Bronze Medal.

CLASS V.—POULTRY.

SECTION

1 For the best Coloured Dorking Cock and 2 Hens—The Silver Medal.
For the second best—The Bronze Medal.

2 For the best White Dorking Cock and 2 Hens—The Silver Medal.
For the second best—The Bronze Medal.

3 For the best Coloured Cochin-China Cock and 2 Hens—The Silver Medal.
For the second best—The Bronze Medal.

4 For the best White Cochin-China Cock and 2 Hens—The Silver Medal.
For the second best—The Bronze Medal.

5 For the best Bramahpootra Cock and 2 Hens—The Silver Medal.
For the second best—The Bronze Medal.

6 For the best Malay Cock and 2 Hens—The Silver Medal.
For the second best—The Bronze Medal.

7 For the best Spanish Cock and 2 Hens—The Silver Medal.
For the second best—The Bronze Medal.

8 For the best Golden Hamburgh Cock and 2 Hens—The Silver Medal.
For the second best—The Bronze Medal.

9 For the best Silver Hamburg Cock and 2 Hens—The Silver Medal.
For the second best—The Bronze Medal.

10 For the best Poland Cock and 2 Hens—The Silver Medal.
For the second best—The Bronze Medal.

11 For the best Game Cock and 2 Hens—The Silver Medal.
For the second best—The Bronze Medal.

12 For the best Cock and 2 Hens, any other breed—The Silver Medal.
For the second best—The Bronze Medal.

13 For the best Bantam Cock and 2 Hens—The Silver Medal.
For the second best—The Bronze Medal.

14 For the best 3 Capons of any breed—The Silver Medal.
For the second best—The Bronze Medal.

15 For the best White Aylesbury Drake and 2 Ducks—The Silver Medal.
For the second best—The Bronze Medal.

16 For the best Rouen Drake and 2 Ducks—The Silver Medal.
For the second best—The Bronze Medal.

SECTION

17 For the best Drake and 2 Ducks, any other breed—The Silver Medal.
For the second best—The Bronze Medal.

18 For the best Black Norfolk Turkey Cock and 2 Hens—The Silver Medal.
For the second best—The Bronze Medal.

19 For the best Turkey Cock and 2 Hens, any other breed—The Silver Medal.
For the second best—The Bronze Medal.

20 For the best Gander and 2 Geese—The Silver Medal.
For the second best—The Bronze Medal.

CLASS VI.—DAIRY PRODUCE.

SECTION

1 For the best sample of Cured Butter—Five Sovereigns.
For the second best—Three Sovereigns.
For the third best—The Bronze Medal.

2 For the best sample of Powdered Butter—Five Sovereigns.
For the second best—Three Sovereigns.
For the third best—The Bronze Medal.

3 For the best sample of Fresh Butter—Five Sovereigns.
For the second best—Three Sovereigns.
For the third best—The Bronze Medal.

4 For the best Two Sweet Milk Cheeses—Five Sovereigns.
For the second best—Three Sovereigns.
For the third best—The Bronze Medal.

5 For the best Two Skimmed Milk Cheeses—Five Sovereigns.
For the second best—Three Sovereigns.
For the third best—The Bronze Medal.

6 For the best Two English Cheeses—Five Sovereigns.
For the second best—Three Sovereigns.
For the third best—The Bronze Medal.

7 For the best Two Imitation English Cheeses—Five Sovereigns.
For the second best—Three Sovereigns.
For the third best—The Bronze Medal.

CLASS VII.—IMPLEMENTS AND MACHINES.

SECTION

1 For the best Two-horse Plough for general purposes—Three Sovereigns.

SECTION

2 For the best Trench or Deep-Furrow Plough—Three Sovereigns.

3 For the best Subsoil Plough for Two Horses—Four Sovereigns.

4 For the best Subsoil Plough for Moor or Stony Land, for Three or Four Horses—Four Sovereigns.

5 For the best Double Mould-Board Plough for forming Drills—Three Sovereigns.

6 For the best Ribbing or Drill-Paring Plough—Two Sovereigns.

7 For the best Two-Horse Grubber or Cultivator—Four Sovereigns.

8 For the best Drill-Grubber for Green Crops—Two Sovereigns.

9 For the best Norwegian Harrow—Four Sovereigns.

10 For the best Consolidating Land-Roller—Five Sovereigns.

11 For the best Pulverizing Land-Roller—Five Sovereigns.

12 For the best Land-Presser for preparing Seed-bed for Grain—Five Sovereigns.

13 For the best Ribbing Machine—Two Sovereigns.

14 For the best Harrows for Heavy Land—Three Sovereigns.

15 For the best Harrows for Light Land—Three Sovereigns.

16 For the best Common Swing-Trees or Draught-Bars—One Sovereign.

17 For the best Equalizing Swing-Trees or Draught-Bars—One Sovereign.

18 For the best Horse-Hoe for Drilled Grain Crops—Six Sovereigns.

19 For the best Broadcast Sowing-machine for Grain and Grass—Six Sovereigns.

20 For the best Drill Sowing-machine for Grain—Six Sovereigns.

21 For the best Sowing-machine for Turnips—Four Sovereigns.

22 For the best Sowing-machine for Turnips with Manure—Five Sovereigns.

23 For the best Dibbling or Drop Sowing-machine for Turnips with Manure—Three Sovereigns.

24 For the best Sowing-machine for Mangold Wurzel—Four Sovereigns.

25 For the best Three-row Sowing-machine for Beans—Four Sovereigns.

26 For the best One-row Sowing-machine for Beans—One Sovereign.

SECTION

27 For the best Dry Manure Distributing-machine — Four Sovereigns.
28 For the best Liquid Manure Distributing-machine—Four Sovereigns.
29 For the best Liquid Manure Pump—Two Sovereigns.
30 For the best Straw-Cutter for Hand-labour—Two Sovereigns.
31 For the best Straw-Cutter for Power—Three Sovereigns.
32 For the best Turnip-Cutter for Sheep—Two Sovereigns.
33 For the best Turnip-Cutter for Cattle—Two Sovereigns.
34 For the best Turnip-Cutter for Sheep, attachable to a Cart —Three Sovereigns.
35 For the best Oil-Cake Bruiser for Hand-labour—Two Sovereigns.
36 For the best Grain and Oil-Cake Bruiser for Power—Four Sovereigns.
37 For the best Grain Grinder, attachable to Thrashing Power —Four Sovereigns.
38 For the best Machine for Digging Potatoes—Four Sovereigns.
39 For the best Machine for Singling Turnips—Four Sovereigns.
40 For the best Machine for Pulping Turnips—Four Sovereigns.
41 For the best Root-Washer—Two Sovereigns.
42 For the best Steaming Apparatus for Preparing Food—Five Sovereigns.
43 For the best Feeding Troughs for Byres—One Sovereign.
44 For the best Feeding Troughs for Sheep—One Sovereign.
45 For the best Sheep-Fodder Rack—Two Sovereigns.
46 For the best One-Horse Farm-Cart—Four Sovereigns.
47 For the best Light Spring Cart—Four Sovereigns.
48 For the best Harvest Cart—Four Sovereigns.
49 For the best Apparatus for conveying Implements on the Farm—Three Sovereigns.
50 For the best Stone or Iron Stack Pillars, with Framework—Two Sovereigns.
51 For the best Horse Stubble or Hay Rake—Two Sovereigns.
52 For the best Scythe for general purposes—One Sovereign.
53 For the best Improvement on any part of the Thrashing Machine—Five Sovereigns.
54 For the best Thrashing Machine, adapted for two or more horses—Six Sovereigns.
55 For the best Machine to thrash, shake, clean, and prepare Grain for Market—Ten Sovereigns.
56 For the best Hummeler for attachment to a Thrashing Machine—Three Sovereigns.

SECTION

57 For the best Dressing Fanners—Four Sovereigns.

58 For the best Weighing Machine for Grain, indicating measure and weight—Four Sovereigns.

59 For the best Weighing Machine, indicating from 1 lb. to 2 tons—Four Sovereigns.

60 For the best Churn worked by Hand—Two Sovereigns.

61 For the best Churn worked by Power—Three Sovereigns.

62 For the best Cheese Press—Two Sovereigns.

63 For the best Curd Cutter for Dairy purposes—One Sovereign.

64 For the best General Set of Dairy Utensils—One Sovereign.

65 For the best Field Gate, constructed entirely of Iron—One Sovereign.

66 For the best Field Gate, not constructed entirely of Iron—One Sovereign.

67 For the best Gate for Dunghill, to open at different elevations—One Sovereign.

68 For the best Iron Hurdles for Cattle Fence—One Sovereign.

69 For the best Iron Netting for Sheep Fence—One Sovereign.

70 For the best Traverse Divisions, Rack and Manger, for Farm Stables—One Sovereign.

71 For the best Farm Harness—One Sovereign.

72 For the best Tiles and Pipes for Field-Drainage—One Sovereign.

73 For the best Glazed Socketed Pipes for Sewerage—One Sovereign.

74 For the best Tools for Cutting Field Drains—One Sovereign.

75 For the best Tools for Cutting Open Drains in Hill Pastures—One Sovereign.

76 For the best General Set of Hand Implements for the Farm—Two Sovereigns.

77 For the best Self-Registering Dynamometer for Draught—Five Sovereigns.

78 For the best Self-Registering Dynamometer for fixed Machines—Five Sovereigns.

EXTRA IMPLEMENTS.

Premiums to the amount of Thirty Sovereigns, Medals, or Certificates of Merit, will further be awarded for Inventions or Improvements not included among the foregoing, but entered on the EXTRA LIST, and specially commended by the Judges.

GENERAL REGULATIONS.

1. Members of the Society, and Candidates for admission, have access to the Show-Yard without payment, and may exhibit, free of entry-money, three Lots of Stock, and one Lot of Implements, Dairy Produce, or Poultry, under any section. *For Stock*, Members shall pay on each Lot exceeding three, and non-Members on all Lots—2½ per cent. on the highest Premium for which the entry is made. For *Implements*, *Poultry*, and *Dairy Produce*, Members shall pay on each Lot exceeding one, and non-Members on all Lots, 2s. 6d. of entry.

2. Stock must be the property, and in the possession, of the Exhibitor from the date of the Certificate of Entry, and the age must be stated in the Certificate.

3. Cows must have calved, or be in calf at the time of the Show.

4. Evidence may be required that Stallions and Bulls have had produce.

5. Mares in section 5 must have foals at foot. Mares in section 6 must be in foal, and awards will be suspended till birth is certified.

6. Ewes and Gimmers must be taken from regular breeding hirsels, and Ewes must rear lambs in 1857.

7. An Animal which has gained a first Premium at a General Show of the Society cannot again compete in the same class, but may be exhibited as Extra Stock for the Silver Medal.

8. The Premiums awarded will be paid on or after the 10th of February 1858. *Premiums not applied for within two years from the term of payment will be forfeited.*

9. The decisions of the Judges, as confirmed by the Directors, are final, and no appeal is competent.

CERTIFICATES OF ENTRY.

10. Every Lot must be intimated by a Certificate of Entry, lodged *not later than Thursday the 18th of June.* Printed forms will be issued on application.

11. Admission-Orders to the Yard for Stock, &c. &c., will be given when the Certificates of Entry are lodged.

PLACING AND JUDGING IMPLEMENTS.

12. The Show-Yard will be open for the reception of IMPLEMENTS on Monday the 3d of August, and all Articles must be placed by 12 o'clock, on Tuesday the 4th of August. No article will be admitted without an admission-order, and *the different articles must be placed in their respective Sections according to the classification in the Premium List.*

13. A separate space will be reserved for Exhibitors who are desirous of showing a general collection, and a moderate charge will be made, according to the ground required, the extent of which must be intimated on or before the 18th of June.

14. The Judges will commence their inspection on Tuesday, the 4th of August, at Twelve, and they will resume it the following morning at Seven. Practical utility will be considered more than mere ingenuity of design; substantial workmanship will be preferred to highly finished execution; and due weight will in all cases be given to economy, both as regards the price of the

Implement, and the saving of labour effected by it. The materials must be the same as those in ordinary use for sale, and the *bona fide* price must be attached.

15. A trial of Implements will take place during the forenoon of Wednesday the 5th; and at One o'clock the Yard will be opened to the public.

16. No article to be removed from the Yard till Four o'clock on Thursday, the 6th of August.

PLACING AND JUDGING DAIRY PRODUCE AND POULTRY.

17. Dairy Produce and Poultry must be brought to the Show-Yard between Eight and Ten o'clock on the morning of Wednesday the 5th. No Lot will be admitted without an admission-order.

18. Samples of Cured and Powdered Butter not to be less than 14 lbs. Fresh Butter to be in three ½ lb. rolls. Dairy Produce must be made on the Exhibitor's farm in 1857. At least 1 cwt. of the variety of Butter, and 2 cwt. of that of the Cheese, exhibited, must have been made during the season. The lots shall be fair samples, and untasted.

19. The Judges will be in attendance at Ten, and the Exhibition will be opened to the public at One o'clock.

20. No article to be removed from the Yard till Four o'clock on Thursday.

PLACING AND JUDGING STOCK.

21. Stock must be brought to the Show-Yard between Five and Seven o'clock on the morning of Thursday, the 6th of August. No Lot will be admitted without an admission-order. At Seven o'clock the Show-Yard will be cleared of all persons except the Judges and Servants in charge of the Stock.

22. One Servant will be admitted with each Lot, and he must remain strictly in charge of it during the Show. Bulls must be secured by a ring or screw in the nose, with a chain or rope attached. The competing Stock will be distinguished by numbers, and the Owner's name must not be mentioned till the Premiums are decided.

23. The Judges will commence their inspection at Seven o'clock. They will decide without inquiry as to the names of parties or places, and with reference merely to the numbers which distinguish the animals. They will have regard to the symmetry, early maturity, purity, size, and general qualities characteristic of the different breeds; and they will be prohibited from awarding Premiums to overfed animals, the object of the Society being to discourage the practice of showing breeding stock in an improper state of fatness. In no case shall a Premium be awarded unless the Judges deem the animals to have sufficient merit, more especially if there is only one Lot in a section; and it shall be in their power to suggest the removal of any Lot which appears to them unworthy of being placed in the Yard.

24. A Member of Committee will attend each Section of the Judges. It will be his duty to see that no obstruction is offered to them; to communicate between them and the Secretary; to complete their reports; and to ticket the prize animals. None of the tickets so placed shall be removed. The Yard will be open to the public on Thursday at Eleven o'clock.

25. On Thursday the Stock will be withdrawn, and the Show-Yard closed at Four o'clock.

EXHIBITION OF PRIZE STOCK.

26. All the Prize Animals, Poultry, Implements, and other articles, must be on the Show-Ground by Ten o'clock on the morning of Friday the 7th of August, or their Premiums will be forfeited. They may be removed at One o'clock.

Forms of Certificates, List of Premiums, and Copies of the Regulations, to be had on application to the Secretary, No. 6 Albyn Place, Edinburgh; or to Robert M'Cowan, Esq., 17 Gordon Street, Glasgow, Secretary to the Local Committee.

Stock, Implements, &c., will be carried by the Scotch Railways to the Show at the usual rates, but will be returned free when unsold.

AGRICULTURAL MEETING,

AND

GENERAL SHOW OF STOCK AND IMPLEMENTS,

At ABERDEEN, in 1858.

The SOCIETY'S MEETING will take place at ABERDEEN in 1858, when Premiums, the amount of which will be afterwards intimated, will be offered for the following Classes of Stock.

The District connected with the SHOW will comprise the Counties of ABERDEEN, BANFF, KINCARDINE, and the Eastern division of Forfar.

CATTLE.

SHORT-HORN.

Bulls calved before 1st January............1856.
Bulls calved after 1st January...............1856.
Bulls calved after 1st January...............1857.
Cows of any age.
Heifers calved after 1st January.........1856.
Heifers calved after 1st January.........1857.

POLLED.

Bulls calved before 1st January............1856.
Bulls calved after 1st January.............1856.
Bulls calved after 1st January.............1857.
Cows of any age.

Heifers calved after 1st January..........1856.
Heifers calved after 1st January..........1857.

AYRSHIRE.

Bulls calved before 1st January............1856.
Bulls calved after 1st January..............1856.
Cows in Milk of any age.
Cows in Calf of any age.
Heifers calved after 1st January..........1856.

HIGHLAND.

Bulls calved before 1st January............1856.
Bulls calved after 1st January ....1856.
Cows of any age.
Heifers calved after 1st January..........1855.
Heifers calved after 1st January...........1856.

HORSES,

For Agricultural Purposes.

Stallions foaled before 1st January.......1855.
Entire Colts foaled after 1st January...1855.
Entire Colts foaled after 1st January...1856.
Entire Colts foaled after 1st January...1857.
Brood Mares foaled before 1st January...1855.
Fillies foaled after 1st January............1855.
Fillies foaled after 1st January............1856.
Fillies foaled after 1st January............1857.

SHEEP.

LEICESTER.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

CHEVIOT.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

BLACK-FACED.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

SOUTHDOWN.

Tups not more than four shear.
Dinmont or Shearling Tups.
Ewes not more than four shear.
Shearling Ewes or Gimmers.

LONG-WOOLLED SHEEP OTHER THAN LEICESTER.

Tups not more than four shear.
Ewes not more than four shear.

Note.—Ewes and Gimmers to be exhibited in pens of three.

SWINE.

Boars, large breed.	Sows, large breed.
Boars, small breed.	Sows, small breed.

Pigs not exceeding 8 months old.

EXTRA STOCK.

CROSSES.

Cows of any age.
Heifers calved after 1st January...1856
Heifers calved after 1st January...1857

POULTRY.

Coloured Dorking.	Spanish.
White Dorking.	Golden Hamburgh.
Coloured Cochin-China.	Silver Hamburgh.
White Cochin-China.	Poland.
Bramahpootra.	Game.
Malay.	Any other distinct breed.

Bantams.	Any other breed.
Capons.	Black Norfolk Turkeys.
White Aylesbury Ducks.	Turkeys, any other brood.
Rouen Ducks.	Geese.

IMPLEMENTS.

The Premiums will be substantially the same as those offered at Glasgow.

VETERINARY COLLEGE.

This establishment is conducted by Professor Dick, assisted by Mr Gamgee, Dr Allen Dalzell, and Mr Worthington. The curriculum embraces the principles and practice of Veterinary Medicine and Surgery, with Anatomy, Physiology, and Demonstrations; Chemistry; Materia Medica and Dietetics; and the general management of domesticated Animals.

Students have the advantage of assisting in an extensive practice, and of performing the different operations which most frequently occur.

Attendance on Two Courses is required before a Student is taken upon trial for diploma; the examinations are conducted by Professor Goodsir and the leading members of the Medical Faculty; and the Graduates of the College are eligible for appointments as Veterinary Surgeons in Her Majesty's Service, and that of the East India Company.

MUSEUM.

The Museum, George IV. Bridge, is open from eleven till three o'clock every day, except Monday. The public are admitted on inscribing their names in the Visitors' Book. Persons desirous of preserving objects illustrative of the Vegetable products of the country are invited to transmit them to the Conservator of the Museum.

MONTHLY MEETINGS.

Periodical Meetings are held in the Museum, when papers are read, and subjects in the science and practice of Agriculture are discussed. Strangers are admitted, but cannot take part in the business.

LABORATORY.

Dr Anderson, the Society's Chemist, will receive communications on all subjects connected with the Chemical Department, at the Laboratory, 15 Shuttle Street, Glasgow.

The following are the rates at which analyses, &c., are furnished to *Members of the Society*:—

1. Complete analysis of a Soil, including determination of alkalies and phosphates, £3.
2. A partial analysis of a Soil, such as the determination of the quantity of organic matter, and relative proportion of clay, sand, and carbonate of lime it contains, 10s.
3. Quantitative determination of any one ingredient of a Soil, 7s. 6d.
4. Complete analysis of Saline Manures and other substances, such as Gypsum, Nitrates of Soda and Potash, Ammoniacal Salts, Guano, Oil-Cake, Bone-Dust, Rape-Dust, Superphosphate of Lime, £1.
5. Testing any of the above substances for adulterations,—for each sample, 5s.

   This examination is sufficient to determine whether or not any of these substances are grossly adulterated, but it gives no idea of the comparative value of different Samples where all are genuine.
6. Determining the quantity of soluble and insoluble phosphates in a superphosphate, 10s.

   This determination generally suffices to show whether the sample is of fair quality, and corresponds with the analysis by which it was sold, but not to fix its exact commercial value.
7. Complete analysis of limestones, marls, shell-sands, &c. £1.
8. Examining any of the above substances for the quantity of lime, and ascertaining in the same the presence of Magnesia and Alumina, 7s. 6d.

   Ascertaining the proportion of these, 2s. 6d. additional for each substance.
9. Complete analysis of the Ashes of any Plant, £3.
10. Complete analysis of a water, £2.
11. Determination of the amount of salts in solution, and of the lime thrown down by boiling in any water, 10s.

12. Analysis of Tile or Fire-Clay, £1, 10s.
13. Complete analysis of roots, grains, and other vegetable products, £1.
14. Examining products of Vegetation, or of the Dairy, such as nutritive matters in Wheat, or other grain—quantity of butter or cheese in milk—5s. for each ingredient.
15. Determination of the quantity of nitrogen in any substance, 7s. 6d.
16. Answers to letters asking advice on subjects within the department of the Chemist, 5s.

The charges for other analyses not specified in the list will be settled by the Committee of Management, with reference to the amount of work which they involve, and on a scale similar to the above.

INSTRUCTIONS FOR SELECTING SAMPLES FOR ANALYSIS.

Much inconvenience and delay having been experienced by persons sending samples for Analysis which had not been sufficiently carefully selected, and were afterwards found not to represent the average composition of the substance, it is particularly requested that the following instructions may be attended to as closely as circumstances will permit.

Manures.—A large handful of the Manure should be taken from each of *at least* five or six different parts of the cargo, and if any lumps are found in it, a due proportion of these should also be taken. The whole being laid on a large sheet of paper, should be carefully mixed by rubbing with the hand, the lumps being broken down and mixed as uniformly as possible with the powdery part. If this mixture be carefully made, a quantity of it not exceeding *two ounces* will suffice for the analysis. It should be folded up in tinfoil to prevent its becoming dry, and is most cheaply and expeditiously forwarded by post. In default of tinfoil, the sample may be wrapped in double folds of strong writing paper; and if the paper be well rubbed with wax, so as to make it impervious to moisture, it will answer nearly as well. Should the manure contain stones, or be very moist, or should any difficulty be experienced in making a uniform mixture, it is desirable that *two or three pounds* should be sent.

Soils.—In selecting Soils for Analysis, five or six spadefuls should be taken from different parts of the field, and, after being spread out in a thin layer for several days to dry, should be put two or three times through a fine sieve, so as to insure uniform mixture. For a complete analysis, not less than *four pounds* should be sent; for a partial analysis, three or four ounces will be sufficient.

Waters.—For the complete analysis of a water, about *two gallons* are required; for the determination of the amount of salts in solution, and lime thrown down by boiling, *a quart* will suffice. A well-water may be selected at any time; but the water of a spring or running stream should be taken in dry weather. The jars or bottles in which they are sent must be tightly corked and sealed. In the analysis of a mineral water, it may sometimes be desirable to determine the amount of gases held in solution, in which case certain precautions must be observed which require the presence of a Chemist at the spring.

Limestones, Clays, Ironstones, &c.—If the bed of any of these substances of which the analysis is required be very uniform in appearance, a piece of two or three ounces weight, taken from any part of it, will be enough for analysis; but in all cases it is better to send three or four chips from different parts of its thickness. Sometimes, where the characters of different parts of the bed vary much, separate analyses of these portions may be requisite, in which case two ounces of each may be sent.

Every sample sent for analysis should be distinctly labelled, and marked with the name and address of the sender in full, and mentioning whether he is a Member of the Society, and in the case of imported manures, the name of the ship should, if possible, be stated. All samples should be accompanied by a letter, specifying the nature of the information required, and, if possible, the object in view, as, by doing so, much trouble and delay will occasionally be saved.

By order of the Directors,

J[N]. HALL MAXWELL, *Secretary.*

EDINBURGH, 6 ALBYN PLACE,
Feb. 10, 1857.

LIST OF MEMBERS

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

AT 28TH FEBRUARY 1857.

ALPHABETICALLY ARRANGED, AND DISTINGUISHING THE YEAR OF ADMISSION.

President.

THE DUKE OF HAMILTON AND BRANDON.

The Members marked *, have been Presidents; and † Vice-Presidents.

New Members are admitted at the General Meetings of the Society by Ballot. There are two such Meetings annually, viz., the Annual Meeting in January, and the Summer General Meeting, on such day in June or July as may be fixed by the Directors, and intimated in terms of the Charter. The ordinary Subscription is £1, 3s. 6d. annually, which may be redeemed by one payment, varying from £12, 12s. to £7, 1s. Tenant Farmers, Members of any Local Association, are admitted on a Subscription of 10s. annually, or £5, 5s. for life.

EDINBURGH:
PRINTED BY NEILL AND COMPANY.
MDCCCLVII.

LIST OF MEMBERS.

	Admitted
His Majesty NAPOLEON III., Emperor of the French, *Honorary Associate*	1856
His Royal Highness PRINCE ALBERT, *Honorary Member*	1841

	ARGYLL, His Grace George, Duke of K. T.	1844
	ATHOLE, His Grace George Augustus Frederick John, Duke of, K.T.	1834
	ATHOLE, Her Grace Ann, Duchess of	1841
	† AILSA, The Most Noble Archibald, Marquis of	1847
	ABERCORN, The Most Noble James, Marquis of, K.G.	1833
	AIRLIE, The Right Hon. David Graham Drummond, Earl of	1852
	† ABERDEEN, The Right Hon. George, Earl of, K.G., K.T.	1805
10	† ARBUTHNOTT, The Right Hon. John, Viscount	1803
	ABINGER, The Right Hon. R. C., Lord	1841
	ABERDOUR, The Right Hon. Sholto John, Lord	1846
	ARBUTHNOTT, Lieut.-General the Hon. Hugh, M.P. for Kincardineshire	1811
	ARBUTHNOTT, The Hon. John	1833
	AGNEW, Sir Andrew, of Lochnaw, Bart., M.P.	1850
	ABERCROMBY, Sir George S., of Birkenbog and Forglen, Bart.	1850
	ABERCROMBY, Lady, of Birkenbog and Netherlaw	1840
	ANSTRUTHER, Sir Windham Carmichael, of Anstruther and Carmichael, Bart.	1842
	ARDMILLAN, The Hon. Lord	1853
20	ANSTRUTHER, Sir Ralph Abercrombie, of Balcaskie and Watten, Bart.	1832

		Admitted
	ANTROBUS, Sir Edmund, of Rutherford, Bart.	1829
	ARBUTHNOT, Sir Robert Keith, Bart.	1852
	ALISON, Sir Archibald, Bart., Sheriff of Lanarkshire	1838
	ALEXANDER, Sir James Edward	1831
	ANDERSON, Sir James, M.P., Glasgow	1843
	ANGRAND, The Chevalier	1839
	Abercromby, Alexander, Glasgow	1844
	Abercromby, Arthur, of Glasshaugh	1832
	Adair, John, of Genoch	1829
30	Adam, Æneas, Humberston, Dingwall	1855
	Adam, James, S.S.C.	1842
	Adam, James Graham, Denovan Field, Denny	1839
	Adam, Robert Parker, of Tour	1849
	Adam, Stephen, Wool-Merchant, Leith	1856
	Adam, William, of Ranna, Advocate, Aberdeen	1839
	Adam, William, Bush, Banchory	1857
	Adam, William Patrick, of Blair-Adam	1853
	Adamson, David, Stanochy, Brechin	1854
	Adamson, James, Morphie, Montrose	1850
40	Addie, Robert, of Viewpark	1844
	Agnew, Robert Vans, of Sheuchan and Barnbarroch	1843
	Ainslie, John, Hillend, Pentland, Loanhead	1848
	Ainslie, Philip B.	1826
	Ainslie, Robert, W.S.	1847
	Ainslie, Robert, of Elvingston	1853
	Aitchison, Francis, Edinburgh	1831
	Aitchison, James, of Alderston	1822
	Aitchison, James, Proney Mains, Dornoch	1851
	Aitchison, John, Brewer, Edinburgh	1852
50	Aitchison, Lieut.-General John, London	1852
	Aitchison, William, Linhope, Hawick	1835
	Aitken, James, of Gartcows	1834
	Aitken, James, Sunnyside, Prestonkirk	1854
	Aitken, Thomas, Listonshiels, Balerno	1854
	Aitken, William, Chapel Colliery, Wishaw	1855
	Aiton, Rev. John, D.D., Minister of Dolphinton	1828
	Alexander, Alexander Humphreys	1825
	Alexander, Boyd, of Ballochmyle	1823
	Alexander, Charles, Inversanda, Ardgour	1856
60	Alexander, James, of Balmule	1842
	Alexander, James, Firbank, Lasswade	1848
	Alexander, John, Banff	1855
	Alison, Alexander, Glasgow	1844
	Alison, Thomas, of Calder Mill, Carstairs	1854
	Allan, Alexander, Advocate	1833

		Admitted
	Allan, Alexander, Drummond, Evanton	1853
	Allan, Alexander, Drummandrioch, Dingwall	1853
	Allan, Lieut.-Colonel, Edinburgh	1847
	Allan, James, Clifton Mains, Kirkliston	1851
70	Allan, James, Clauchan, Arran	1855
	Allan, James, West Mains, Stonehouse	1852
	Allan, John, Billie Mains, Ayton	1854
	Allan, Thomas, Foggorig, Dunse	1853
	Allan, Thomas William Murray, of Havering, Essex	1852
	Allan, William, Edinburgh	1830
	Allan, William, Winchburgh	1852
	Allen, James, Merchant, Glasgow	1815
	Alston, James W., of Stockbriggs	1844
	Alston, John Patrick, of Muirburn	1850
80	Anderson, Alexander, Advocate, Aberdeen	1838
	Anderson, A. D., M.D., Glasgow	1844
	Anderson, David, of Moredun	1825
	Anderson, David, of St Germains	1829
	Anderson, David, Westhaven, Dundee	1843
	Anderson, David, Blackdykes, North Berwick	1852
	Anderson, George, Solicitor, Inverness	1839
	Anderson, George, Glasgow	1844
	Anderson, James, Laggan, Ballantrae	1838
	Anderson, James A., of Carlung	1838
90	Anderson, John, Lewinshope, Selkirk	1852
	Anderson, John, Merchant, London	1838
	Anderson, John, Merchant, Glasgow	1833
	Anderson, John, Strichen	1840
	Anderson, John, Craigton, Banchory	1857
	Anderson, Lawrence, Chapel, Moffat	1851
	Anderson, Michael, Edinburgh	1831
	Anderson, Robert, Meikle Kildrummy, Nairn	1856
	Anderson, Robert Hood, Glasgow	1850
	Anderson, Stephen, of Carfin	1849
100	Anderson, Thomas, of Glendrisaig, Sheriff-Substitute, Kilmarnock	1832
	Anderson, Thomas, M.D., Professor of Chemistry, University of Glasgow, Chemist to the Society	1849
	Anderson, Thomas Scott, W.S.	1854
	Anderson, William, Town-Clerk of Leith	1842
	Anderson, William, Hattonburn, Banchory	1857
	Anderson, William, New Mill, Banchory	1857
	Anderson, William James, Edinburgh	1840
	Angus, Ritchie, Glasgow	1844
	Anstruther, James, Moray Place, Edinburgh	1827

		Admitted
	Anstruther, Philip, London	1846
110	Arbuthnot, George Clerk, of Mavisbank	1844
	Arbuthnot, Thomas, of Meethill	1829
	Arbuthnott, James Carnegy, of Balnamoon	1813
	Archbald, Thomas, Carrington Mains, Lasswade	1855
	Archer, Andrew, Abbey Hill, Coupar-Angus	1846
	Archibald, John, Duddingston, South Queensferry	1849
	Arklay, John, Powmill, Brechin	1853
	Arklay, Robert, Philpston, South Queensferry	1854
	Arkley, Patrick, of Duninald, Advocate	1840
	Arkley, Robert H., Mains of Duninald, Montrose	1850
120	Armour, Alex. B., Meiklehill, Kirkintilloch	1854
	Armstrong, Chas., of Cherry Valley, County of Antrim	1836
	Arnott, G. A. Walker, of Arlary, LL.D., Professor of Botany, University of Glasgow	1837
	Arnott, James, of Leithfield, W.S.	1835
	Ashby, Shukbrugh, Murrayfield, Edinburgh	1843
	Askew, Henry William	1845
	Auchterlonie, Thomas, Merchant, Glasgow	1850
	Austin, R. Speir	1851
	Aytoun, James, Advocate, Edinburgh	1849
	Aytoun, Roger, of Inchdairnie	1844
130	Aytoun, William Edmonstoune, Advocate, Sheriff of Orkney and Shetland	1838
	BUCKINGHAM and CHANDOS, His Grace Richard Plantagenet, Duke of, K.G., Honorary Member	1837
	*BUCCLEUCH and QUEENSBERRY, His Grace Walter Francis, Duke of, K.G.	1828
	BUCCLEUCH and QUEENSBERRY, Her Grace Charlotte, Duchess of	1835
	†BREADALBANE, The Most Noble John, Marquis of, K.T.	1819
	BREADALBANE, The Most Noble Elizabeth, Marchioness of	1838
	BUCHAN, The Hon. Henry David, Earl of	1811
	†BLANTYRE, The Right Hon. Charles, Lord	1843
	†BELHAVEN and STENTON, The Right Hon. Robert, Lord	1816
	BOYLE, The Hon. George Frederick	1854
140	BRUCE, The Hon. Thomas Charles	1852
	BURNETT, Sir James Horn, of Leys, Bart.	1834
	BRUCE, Sir Michael, of Scotstoun and Stenhouse, Bart.	1825
	BAIRD, Sir James Gardner, of Saughtonhall, Bart.	1843
	BLAIR, Sir David Hunter, of Blairquhan, Bart.	1801

		Admitted
	Baillie, Sir William, of Polkemmet, Bart.	1847
	Boswell, Sir James, of Auchinleck, Bart.	1834
	Boswall, Sir George Houston, of Blackadder, Bart.	1848
	Brisbane, General Sir Thomas Makdougall, of Brisbane and Makerstoun, Bt., G.C.B. and G.C.H.	1801
	Bannerman, Sir Alex., Governor of Newfoundland	1835
150	Blaikie, Sir Thomas, Aberdeen	1840
	Baikie, James, of Tankerness	1818
	Baillie, Charles, Advocate, Sheriff of Stirlingshire	1831
	Baillie, Evan, of Dochfour	1824
	Baillie, George, of Jerviswoode	1841
	Baillie, Henry James, younger of Redcastle, M.P.	1839
	Baillie, Colonel Hugh Duncan, of Redcastle	1839
	Baillie, James Evan, of Glenelg and Kingussie	1839
	Baillie, James William, younger of Culterallers, W.S.	1851
	Baillie, Robert Granbery, of Culterallers	1819
160	Baillie, William R., W.S.,	1848
	Bain, John, of Morriston	1833
	Baird, Alexander, of Ury	1845
	Baird, Charles J.	1844
	Baird, David, of Stitchel	1850
	Baird, George, of Strichen	1838
	Baird, Henry, Grange, Grangemouth	1853
	Baird, James, of Cambusdoon, M.P.	1838
	Baird, John, of Lochwood	1838
	Baird, William, of Elie	1845
170	Baird, William, Grain-Merchant, Glasgow	1844
	Bald, Robert, Civil Engineer, Edinburgh	1828
	Balfour, Charles, of Balgonie	1846
	Balfour, David, of Balfour and Trenabie	1843
	Balfour, James, of Pilrig, W.S.	1824
	Balfour, James, Milton, Leuchars	1842
	Balfour, John, of Balbirnie	1839
	Balfour, John Hutton, M.D., Professor of Botany, University of Edinburgh	1839
	Balfour, Lieut.-Colonel, of Arbigland	1849
	Balfour, William, of Gairsay	1844
180	Balfour, William, Merchant, Glasgow	1820
	Ballantyne, James, of Castlehill	1822
	Ballantyne, James, of Holylee	1832
	Ballantyne, James, Lawhead, Penicuik	1854
	Ballantyne, John, Braid, Edinburgh	1848
	Ballantyne, John, of Woodhouse, Peebles	1856
	Ballantyne, Thomas, Whitehope, Selkirk	1852

		Admitted
	Ballingal, Neil, Seggie, Kinross	1851
	Ballingal, Robert, Fairlie, Largs	1853
	Bannatyne, Dugald John, of Eastbank	1851
190	Barbour, Thomas, of Dalshangan	1846
	Barclay, Arthur Hay, of Paris, Perthshire	1848
	Barclay, George, Davochbeg, Golspie	1855
	Barclay, George Robertson, of Keavil	1834
	Barclay, Colonel P., Edinburgh	1847
	Barclay, Thomas, Mains of Newton, Montrose	1855
	Barker, Thomas, of Sydney, Australia	1839
	Barker, Bradshaw, Wyseby Hill, Ecclefechan	1855
	Barlas, Robert, Edinburgh	1844
	Barnes, Edward M., South Carlington, Rothbury	1854
200	Barns, Patrick Graham, of Limekilns	1836
	Barr, James, Silvertonhill, Hamilton	1847
	Barr, John, Barangry, Bishopton	1851
	Barron, George, Pittenkerie, Banchory	1857
	Barstow, Charles M., Edinburgh	1846
	Bartholomew, James, Duntarvie, Winchburgh	1855
	Bartholomew, John, of Broomhill, Merchant, Glasgow	1838
	Bartholomew, Robert, Merchant, Glasgow	1838
	Baxter, David, of Kilmaron	1843
	Baxter, Edmund, W.S.	1854
210	Bayley, Isaac, of Manuel, Edinburgh	1828
	Beattie, James, Newbie House, Annan	1854
	Begbie, Alexander, Leamington	1832
	Begbie, Thomas, Queenston-bank, Drem	1852
	Beith, John, Banker, Campbeltown	1836
	Belches, Alexander Hepburn Murray, of Invermay	1824
	Belches, Major-General John H. Murray, Invermay	1825
	Belford, Andrew, of Glenfintaig	1839
	Belfrage, George, North Gyle, Corstorphine	1849
	Belfrage, James, Samuelston East Mains, Haddington	1849
220	Bell, Charles, Union Place, Edinburgh	1856
	Bell, David, Mains of Brigton, Forfar	1856
	Bell, George, Merchant, Leith	1826
	Bell, George, Inchmichael, Errol	1852
	Bell, George, of Menslaws	1842
	Bell, George Graham, of Crurie, Advocate	1835
	Bell, George Hamilton, Surgeon, Edinburgh	1848
	Bell, John, of Enterkine	1839
	Bell, John Beatson, of Glenfarg, W.S.	1841
	Bell, John Montgomery, Sheriff of Kincardieshire	1852
230	Bell, Robert, Advocate, Sheriff of Berwickshire	1823

		Admitted
	Bell, Robert, of Lunna, Sheriff-Substitute of Shetland	1846
	Bell, Robert, Architect and Land-Surveyor, Edinburgh	1851
	Bell, Thomas, Moile of Cantyre, Campbeltown	1854
	Bell, Thomas, Ballinshoe, Kirriemuir	1856
	Bell, William, of Gribdae	1840
	Bell, William, West-Bow, Edinburgh	1855
	Bellany, Charles, Hillend, Aytoun	1854
	Bennet, Alexander, Deskie, Ballindalloch	1857
	Bennet, James, Marypark, Ballindalloch	1857
240	Benton, R. E. C., Glasgow	1852
	Berry, John, of Tayfield, Advocate	1848
	Bertram, John S., Cranshaws, Dunse	1854
	Bertram, Thomas Hardy, Engineer, London	1845
	Bertram, William, of Nisbet	1852
	Berwick, Alexander, of Nortonhall	1839
	Berwick, Alexander, junior, Brewer, Edinburgh	1852
	Bethune, Alexander, of Blebo	1848
	Bett, James, Strone, Fort-William	1857
	Beveridge, Erskine, of Brucefield, Dunfermline	1855
250	Beveridge, James, Easter Balado, Secretary, Kinross Agricultural Society	1851
	Beveridge, Robert E., Urquhart, Dunfermline	1853
	Beveridge, Thomas, Depute-Clerk of Session	1816
	Beveridge, Thomas Knox, W.S.	1833
	Bigg, Thomas, London	1842
	Binnie, Robert, Seton Mains, Tranent	1847
	Binning, John, Brae, Dingwall	1849
	Bird, Robert, Renton Barns, Grant's House	1854
	Biscoe, Thomas Porter Bonell, of Newton, Inverness	1846
	Black, Adam, M.P., Edinburgh	1846
260	Black, Alexander, Civil Engineer, Falkirk	1856
	Black, David, Barrelwell, Brechin	1850
	Black, James, Lainshaw, Stewarton	1851
	Black, James, Merchant, Glasgow	1838
	Black, James, Greenlaw Dean, Greenlaw	1854
	Black, James, Knock, Keith	1852
	Black, James Spens, Merchant, Glasgow	1839
	Black, John, Arlary, Kinross	1851
	Black, John, Fern Bank, Bishopbriggs	1855
	Black, Robert, Glasgow	1844
270	Blackburn, James J., Mill of Forest, Stonehaven	1854
	Blackburn, Peter, of Killearn, M.P.	1842
	Blackburn, Robert B., Advocate	1846
	Blackley, John, St Vincent Street, Glasgow	1855

		Admitted
	Blacklock, Adam, Minnygap, Moffat	1857
	Blackwood, John, Publisher, Edinburgh	1842
	Blackwood, Major William, Edinburgh	1851
	Blaikie, John, of Craigiebuckler, Advocate, Aberdeen	1837
	Blair, Colonel Stopford, of Penninghame	1849
	Blair, Edward Hunter, of Dunskey	1850
280	Blair, William, of Avonton	1817
	Blair, Captain William Fordyce, of Blair, R.N.	1844
	Blanchard, George, Merchant, Edinburgh	1847
	Blandow, Michael Von, St Petersburg, Honorary Associate	1336
	Blane, Robert, of Grougar	1836
	Bogie, John, Balcanquhall, Auchtermuchty	1851
	Bogle, James, Merchant, Glasgow	1844
	Bolam, John, Gloroum, Belford	1854
	Bonar, Andrew, Australia	1824
	Bonar, James, Merchant, London	1835
290	Bonar, William, of East Warriston	1828
	Bonar, William Graham, of Greigston	1835
	Bontine, William Cuninghame Graham, of Ardoch	1853
	Boog, William, Luss, Dumbarton	1841
	Booth, James Godfrey, Seed-Merchant, Hamburg	1842
	Booth, Richard, Warlaby, Northallerton	1854
	Borthwick, Gilbert, Cowbog, Kelso	1854
	Borthwick, John, of Crookston	1846
	Borthwick, Thomas Chalmers, Hopsrig, Langholm	1838
	Borthwick, Lieut.-Col., Georgefield, Langholm	1843
300	Boswell, John Douglas, of Garallan	1836
	Boswell, John Irvine, of Kingcaussie and Bulmuto	1823
	Boulderson, Shadwell M., Ord House, Beauly	1840
	Bowie, John, W.S.	1815
	Bowie, Alexander, Mains of Kelly, Arbroath	1854
	Bowhill, Thomas, Banker, Ayton	1853
	Bowman, Thomas, Hallhill, Baillieston	1855
	Boyd, Adam Brack, of Cherrytrees	1841
	Boyd, James B., Clifton, Kelso	1853
	Boyd, John, of Broadmeadows	1804
310	Boyle, Archibald Thomas, Advocate	1846
	Boyle, Patrick, of Shewalton	1835
	Boyle, Robert, Tile Manufacturer, Ayr	1850
	Brace, George, Surrey Street, Strand, London	1856
	Brand, William, Secretary, Union Bank of Scotland	1846
	Brander, James, Avoch, Fortrose	1830
	Brandreth, Humphrey, of Houghton House, Dunstaple	1840

		Admitted
	Brash, James, Hallyards, Kirkliston	1855
	Brebner, James, Advocate, Aberdeen	1834
	Bremner, Charles, W.S.	1800
320	Broad, William, Clifton-hill, Kelso,	1853
	Broadbent, John H., Sealand, Chester	1848
	Broadfoot, John, Merchant, Leith	1851
	Brock, John, Overton, Kirkliston	1851
	Brodie, Alexander, Kademuir, Peebles	1856
	Brodie, Archibald C., Abbey Mains, Haddington	1854
	Brodie, James, Skateraw, Dunbar	1848
	Brodie, James Campbell, of Lethen	1831
	Brodie, John Clerk, W.S.	1840
	Brodie, Patrick, Clarilaw, Selkirk	1834
330	Brodie, William, of Brodie	1821
	Broomfield, Thomas, Lauder, Secretary of the Lauderdale Agricultural Association	1855
	Brotchie, Robert, of Swanny	1855
	Broughton, Robert Henry, Edinburgh	1854
	Broun, Charles Wilsone, of Wemyss	1852
	Brown, Alexander James Dennistoun, of Balloch	1844
	Brown, Andrew, M.D., Edinburgh	1852
	Brown, Major David, of Park	1834
	Brown, David, yr. of Park, W.S.	1856
	Brown, David Wardlaw, of Longformacus	1841
340	Brown, George, Watten Mains, Wick	1839
	Brown, George, Balgarvie, Cupar	1851
	Brown, Hugh H., of Newhall	1843
	Brown, James, Accountant, Edinburgh	1816
	Brown, James, of Lochton, Dundee	1843
	Brown, James, of Orchard	1849
	Brown, James, Liberton Mains, Carnwath	1855
	Brown, James Bertram, Smeaton, Dalkeith	1848
	Brown, Major J. D., Drylawhill, Prestonkirk	1821
	Brown, James Thomas, of Auchlochlan	1837
350	Brown, John, Outterston, Fushie Bridge	1856
	Brown, John George, Pinkie House, Musselburgh	1852
	Brown, Matthew, Greenock	1832
	Brown, Dr, Melrose	1855
	Brown, Peter, Linkwood, Elgin	1821
	Brown, Peter, Rossland, Paisley	1856
	Brown, Robert, Dublin	1856
	Brown, Thomas, Slipperfield, West Linton	1849
	Brown, Thomas, Burton, Belford	1854
	Brown, Walter, of Colton	1854

		Admitted
360	Brown, William, Merchant, Glasgow	1828
	Brown, William, Banker, Maybole	1835
	Brown, William, Merchant, Dundee	1843
	Brown, William, of Greenock Mains, Muirkirk	1850
	Brown, William, Linkwood, Elgin	1854
	Brown, William Henry, of Ashley	1833
	Bruce, C. L. Cumming, of Roseisle and Kinnaird, M.P.	1817
	Bruce, James, Middleton, Mintlaw	1837
	Bruce, John, of Sumburgh, Zetland	1829
	Bruce, John, W.S.	1842
370	Bruce, Robert, of Kennet	1819
	Bruce, Thomas, of Arnot, Kinross	1855
	Bruce, William, of Symbister, Zetland	1838
	Bruce, William, Glasgow	1844
	Bryce, David, Architect, Edinburgh	1846
	Bryce, Rev. James, D.D.	1813
	Brydon, James, Moodlaw, Langholm	1850
	Bryson, Robert, Merchant, Glasgow	1850
	Bryson, W. G., Cullen	1852
	Buchan, William, Dolphinton, South Queensferry	1839
380	Buchanan, Alexander, Whitehouse, Stirling	1854
	Buchanan, Andrew, of Auchintorlie	1838
	Buchanan, Andrew, of Mount Vernon	1827
	Buchanan, David Carrick, of Dumpellier	1849
	Buchanan, Duncan, Auchnabreck, Cairndow	1853
	Buchanan, Isaac, Glasgow	1851
	Buchanan, James, Edinburgh	1820
	Buchanan, James, of Catrine	1838
	Buchanan, John, London	1838
	Buchanan, John, of Glenlora	1844
390	Buchanan, John, of Carbeth	1838
	Buchanan, John, Grange, Edinburgh	1854
	Buchanan, Niel Griffiths, of Knockshinnoch	1850
	Buchanan, Robert, Glasgow	1811
	Buchanan, Rev. Thomas, Methven, Perth	1840
	Buchanan, Thomas, of Wellshot, Glasgow	1849
	Buchanan, Walter, of Shandon	1842
	Buchanan, William, Merchant, Glasgow	1828
	Buist, James, Kirkton Barns, Newport	1842
	Buist, Mathew, Tynninghame, Prestonkirk	1848
400	Burn, Henry J., Cuttlehill, W.S.	1843
	Burn, James, W.S.	1825
	Burn, William, Architect, London	1824
	Burnet, James, Aberlady, Drem	1854

		Admitted
	Burnett, Alexander, Kinchyle, Inverness	1839
	Burnett, George, Advocate	1848
	Burnett, Gregory, Dee Cottage, Flint	1840
	Burnett, John Joseph, of Gadgirth	1836
	Burnett, Newell, Advocate, Aberdeen	1834
	Burroughs, Wm. Frederick Traill, of Rolfsea, Orkney	1854
410	Burnley, W. F., Ainslie Place, Edinburgh	1838
	Burt, Dr John, Edinburgh	1831
	Burton, William Tait, of Toxside	1848
	Butter, Archibald, of Faskally	1825
	Buttery, A. W., Monkland Iron-Works, Airdrie	1844
	CRAWFORD and BALCARRES, The Right Hon. James, Earl of	1847
	CAITHNESS, The Right Hon. James, Earl of	1845
	†CATHCART, General, Rt. Hon. Charles, Earl, K.C.B.	1809
	†CAWDOR, The Right Hon. John Frederick, Earl	1831
	COLVILLE (of Culross), The Right Hon. Charles John, Lord	1851
420	CAMPBELL, The Right Hon. John, Lord	1834
	CLERK, The Right Hon. Sir George, of Penicuick, Bart.	1812
	COWAN, The Hon. Lord	1848
	CURRIEHILL, The Hon. Lord	1822
	CATHCART, Colonel The Hon. Frederick Macadam, of Craigengillan	1830
	CARNEGIE, The Hon. Charles, Kinnaird Castle	1856
	COLQUHOUN, Sir James, of Luss, Bart.	1829
	CAMPBELL, Sir James, of Aberuchil and Kilbride, Bart.	1838
	CARMICHAEL, Sir William H. Gibson, of Castle-Craig and Skerling, Bart.	1856
	CAMPBELL, Sir Hugh Hume, of Marchmont, Bart.	1834
430	CATHCART, Sir John Andrew, of Carleton, Bart.	1834
	CUMMING, Sir Alexander Penrose Gordon, of Altyre and Gordonston, Bart.	1846
	COLEBROOKE, Sir Thomas Edward, of Crawford, Bart.	1838
	CAMPBELL, Sir Archibald Islay, of Succoth, Bart., M.P.	1844
	CAMERON, Sir Duncan, of Fassfern, Bart.	1800
	CRAIG, Sir William Gibson, of Riccarton, Bart.	1824
	CAMPBELL, Sir Alexander, of Barcaldine, Bart.	1845
	CAMPBELL, Sir Angus, of Dunstaffnage, Bart.	1851
	CAMPBELL, Sir James, of Stracathro, Glasgow	1838
	COCHRANE, Admiral Sir Thomas, K.C.B.	1817

		Admitted
440	Chalmers, Lieut.-General Sir William, of Glenericht	1822
	Cadell, Alex. Tod, Madras Army	1844
	Cadell, Lieut.-Colonel George	1842
	Cadell, Henry, yr. of Grange, Linlithgow	1856
	Cadell, Hew Francis, of Cockenzie	1844
	Cadell, James John, of Grange	1848
	Cadell, John, of Tranent, Advocate	1854
	Caird, James, Baldoon, Wigtown	1853
	Calder, Francis, Yetholm Mains, Kelso	1853
	Calder, Marcus, Shapinshay, Kirkwall	1846
450	Calder, William, Cattle-Salesman, Edinburgh	1851
	Caldwell, Frederick, of Missinish	1841
	Callender, Henry, Accountant, Edinburgh	1843
	Cameron, Alexander, Surinam	1819
	Cameron, Alexander, Invercomrie, Pitlochrie	1854
	Cameron, Allan, Calligary, Broadford	1803
	Cameron, Donald, of Lochiel	1834
	Cameron, Hugh Innes	1835
	Cameron, Capt. James, Aberdour House, Fraserburgh	1850
	Cameron, James, Balnakyle, Munlochy	1857
460	Cameron, John, of Barcaldine	1849
	Cameron, John, of Glenesk	1846
	Cameron, Peter, Edinburgh	1850
	Cameron, William, Millhill, Auchterarder	1852
	Campbell, Alexander, of Auchindarroch	1837
	Campbell, Captain Alexander, of Brackley	1806
	Campbell, Alexander, of Monzie	1833
	Campbell, Alexander, London	1804
	Campbell, Alexander, of Barnhill	1833
	Campbell, Alexander, Edinburgh	1835
470	Campbell, Archibald, of Catrinebank	1810
	Campbell, Archibald, of Glendaruel	1826
	Campbell, Archibald, Camserney Cottage, Aberfeldy	1832
	Campbell, Archibald, of Blythswood	1848
	Campbell, Archibald, younger of Lerags, M.D.	1845
	Campbell, Archibald, Sauchie House, Stirling	1855
	Campbell, Archibald James, of Kilpatrick	1824
	Campbell, Arthur, of Condorat, W.S.	1816
	Campbell, Arthur, yr. of Condorat, W.S.	1854
	Campbell, Charles, Greenhill, Edinburgh	1838
480	Campbell, Charles Vercker Hamilton, of Nether Place	1853
	Campbell, Charles William, Edinburgh	1840
	Campbell, Colin, of Colgrain	1829
	Campbell, Colin, yr. of Colgrain	1847
	Campbell, Colin G., younger of Stonefield	1838

		Admitted
	Campbell, David, Kirkforthar, Markinch	1854
	Campbell, Donald, younger of Sonachan	1840
	Campbell, Donald	1846
	Campbell, Dugald M'Neill, of Kintarbet	1847
	Campbell, Farquhar, of Aros, Tobermory	1839
490	Campbell, George, Succoth	1833
	Campbell, George James, of Treesbanks	1835
	Campbell, Henry Fletcher, of Boquham	1823
	Campbell, Humphrey Walter, Dumbarton	1838
	Campbell, Ivie, Dalgig, New Cumnock	1856
	Campbell, James, of Craigie	1824
	Campbell, James, Edinburgh	1838
	Campbell, James, younger of Tillichewan	1847
	Campbell, James, Balbogie, Coupar-Angus	1850
	Campbell, James Archibald, of Inverawe	1833
500	Campbell, James A., younger of Stracathro	1849
	Campbell, John, of Garrows, Amulree	1857
	Campbell, John, of Possil	1848
	Campbell, John, of Stonefield	1808
	Campbell, John, late of Glensaddel	1817
	Campbell, John, of Blairhall	1819
	Campbell, John, of Southall	1821
	Campbell, John, of Strachur	1829
	Campbell, John, of Achalader	1846
	Campbell, John, of Kilberry	1842
510	Campbell, John Archibald, W.S.	1813
	Campbell, John Deans, of Curreath and Loeg	1835
	Campbell, Kenneth, of Ardow	1843
	Campbell, Lorne, Roseneath	1824
	Campbell, Mungo, Glasgow	1837
	Campbell, Mungo, jun., Glasgow	1824
	Campbell, Mungo Nutter, of Ballymore	1832
	Campbell, Ord Graham, Edinburgh	1838
	Campbell, Richard D., of Jura	1836
	Campbell, Robert, of Sonachan	1802
520	Campbell, Robert, of Auchmannoch	1816
	Campbell, Rose	1809
	Campbell, Thomas, Edinburgh	1837
	Campbell, Thomas, of Annfield, Irvine	1856
	Campbell, Thomas Walton, of Walton Park	1856
	Campbell, Lieut.-Col. Walter, N.B. Staff, Glasgow	1836
	Campbell, William, of Tillichewan Castle	1838
	Campbell, William, of Ormsary	1839
	Campbell, William, of Dunmore	1854

Admitted

530 Campion, Richard G., Land-Agent, Busby Park, Rathcormack, County Cork 1855
Cannon, James, Shiel, Castle-Douglas 1813
Cantlie, William, Keithmore, Mortlach 1852
Carfrae, Major-General John, of Bowerhouse 1842
Carfrae, Thomas, Land-Surveyor, Edinburgh 1850
Carlisle, William, of Houstonfield 1835
Carlyle, Thomas Johnstone, of Waterbeck 1845
Carmichael, Michael Thomson, of Eastend 1825
Carnaby, Thomas, Clerk of Lieutenancy, Forfar 1831
Carnegie, David, of Stronvar 1847
540 Carnegie, George R., Edrom-Newton, Ayton 1854
Carnegie, James, of Edrom-Newton, W.S. 1852
Carnegie, John, of Redhall 1836
Carnegie, William Fullarton Lindsay, of Boysack and Kinblethmont 1824
Carnegy, John, 1850
Carruthers, Alexander, of Warmanbie 1826
Carruthers, John, Kirkhill, Moffat 1854
Carruthers, William Francis, of Dormont 1848
Carstairs, Drysdale, Merchant, Liverpool 1838
Carstairs, John, of Springfield 1841
550 Carter, Thomas, Scales, Richmond, Yorkshire 1852
Cassels, Alexander, W.S. 1848
Cassels, David 1824
Cathcart, Elias, of Auchindrane 1819
Cathcart, Taylor, of Carbiston and Pitcairly 1842
Cay, John, Advocate, Sheriff of Linlithgowshire 1841
Chalmer, Major, Larbert House, Stirling 1852
Chalmers, Charles, of Monkshill 1824
Chalmers, David, of Westburn 1834
Chalmers, John Inglis, of Aldbar 1844
560 Chambers, Robert, Edinburgh 1841
Chancellor, John, of Shieldhill, Advocate 1849
Chandler, Henry, Salford 1857
Charge, Thomas, of Barton 1833
Cheape, Robert C., of Strathtyrum 1847
Cheyne, Henry, of Tangwick, W.S. 1838
Cheyne, Mrs, of Lismore 1857
Chiene, George Tod, Edinburgh 1838
Chiene, Patrick, Edinburgh 1820
Chisholm, Duncan Macdonell, of Chisholm 1839
570 Chisholm, John, Drakies, Inverness 1854
Chisholm, Lachlan, late of Lochans 1831
Chisholm, William, Barnyards, Inverness 1856

		Admitted
	Chisholme, John Scott, of Stirches	1839
	Chivas, Alexander, Banker, Aberdeen	1840
	Chivas, George, Seedsman, Chester	1848
	Chrisp, Thomas, Hawkhill, Alnwick	1853
	Christal, Robert, of Inchyra	1852
	Christie, Andrew, Adinston, Tranent	1850
	Christie, Charles J., Westbank, Tranent	1850
580	Christie, Charles Maitland, of Durie	1841
	Christie, Captain James, Hillend, Clackmannan	1835
	Christie, Hugh, Glengoulandie, Aberfeldy	1854
	Christie, John, of Pitgorno	1843
	Christie, John, Northfield House, Annan	1846
	Christie, Robert, Accountant, Edinburgh	1824
	Christie, Robert Stark, of Teasses	1852
	Christison, R., M.D., Professor of Materia Medica, University of Edinburgh	1848
	Chrystal, John, Dasherhead, Gargunnock	1854
	Chrystie, Captain Alexander, H.E.I.C.S.	1834
590	Chrystie, Captain Thomas, R.N.	1841
	Church, D. M., Dalhousie, Dalkeith	1855
	Church, James, Tower of Sark, Canonbie	1838
	Clapperton, John, Newlands, Gifford	1855
	Clapperton, Thomas, Edinburgh	1837
	Clark, Archibald, Inverchapple, Kilmun	1853
	Clark, Francis William, of Ulva	1838
	Clark, James, Wormiston, Crail	1842
	Clark, John, Plean, Stirling	1851
	Clark, John, Flender, Busby	1857
600	Clark, Samuel, Manswrae, Kilbarchan	1852
	Clarke, Alexander, Eriboll, Lairg	1847
	Clarke, George, Stronchrubie, Assynt	1855
	Clason, Rev. Dr Patrick, Edinburgh	1838
	Clay, John, Wynnfield, Dunse	1854
	Clay, John, Kerchesters, Kelso	1854
	Clay, Patrick, Berwick-on-Tweed	1854
	Clayhills, Alexander, of Invergowrie	1838
	Cleghorn, George, of Weens	1821
	Clerk, James, younger, of Penicuik	1847
610	Clerk, James, Ardtaraig, Dunoon	1853
	Clerk, Neil, Balliemore, Dunoon	1853
	Clouston, Peter, Merchant, Glasgow	1850
	Coats, Peter, of Woodside	1852
	Coats, Thomas, of Ferguslie	1852
	Cobb, William, Mains of Fintray, Dundee	1843
	Cobbold, Charles, Broughton Park, Edinburgh	1842

		Admitted
	Cochrane, Alex. Baillie, of Lamington, M.P.	1842
	Cochrane, Henry, Westmains, Broxburn	1854
	Cochrane, James, of Harburn	1849
620	Cochrane, William, New Milton, Roslin	1848
	Cockburn, Thomas, Sisterpath, Dunse	1851
	Cogan, Robert, Merchant, Glasgow	1830
	Coldwells, John, Stobsmills, Fushiebridge	1845
	Cole, Captain William W., 66 Eaton Place, London	1848
	Colledge, William, Pollockshaws	1850
	Collie, James, Haughhead, Laurencekirk	1840
	Collie, John, Ardgay, Forres	1853
	Collier, John, Panlathie, Arbroath	1843
	Collier, Thomas, Hatton, Carnoustie	1835
630	Colquhoun, Archibald Campbell, yr. of Killermont	1854
	Colquhoun, John, Corkerhill, Pollockshaws	1850
	Colquhoun, John Campbell, of Killermont	1824
	Colquhoun, William Lawrence, of Clathick	1838
	Colt, John Hamilton, of Gartsherrie	1844
	Conacher, Alexander, Mains of Pitlochrie, Perthshire	1855
	Condie, George, Writer, Perth	1852
	Condie, James, Blackfriar's House, Perth	1839
	Connal, William, Glasgow	1850
	Connell, Arthur, Professor of Chemistry, St Andrews	1855
640	Connell, James, of Conheath	1848
	Constable, George Nicoll, of Loylziary	1852
	Constable, James Nicoll, of Ballmyle	1843
	Constable, James Nicoll, of Calley	1854
	Conning, John, Writer, Perth	1852
	Cook, John, W.S.	1841
	Cooper, Henry R., of Ballindalloch	1845
	Cooper, William, of Failford	1845
	Copland, David, Cairnfecle, Aberdeen	1833
	Copland, Robert, Haddo House, Aberdeen	1855
650	Cordiner, William F., of Memzie, Cortes	1840
	Corrie, Hugh, younger of Steilson	1841
	Corrie, Thomas, of Steilston, Manager of British Linen Company	1826
	Coubrough, James, Blairtummoch, Campsie	1852
	Coulter, John, Tylefield Street, Glasgow	1833
	Coventry, Andrew, of Pittilloch, Advocate	1844
	Coventry, George Andrew, yr. of Shanwell	1852
	Cowan, Alexander, Merchant, Edinburgh	1810
	Cowan, Charles, M.P., Valleyfield	1836
	Cowan, David, Edinburgh	1844
660	Cowan, Hugh, Corstorphine	1852

		Admitted
	Cowan, James, of Dildawn, LL.D.	1852
	Cowan, James G., Edinburgh	1840
	Cowan, Richard, Merchant, Leith	1854
	Cowie, Alexander, Secretary Ythanside Agricultural Association, Cromley Bank, Ellon	1853
	Cowie, David, Dysart, Montrose	1851
	Cowie, James, Mains of Haulkerton, Laurencekirk	1852
	Craig, David, Papermaker, Portobello	1855
	Craig, James, Surgeon, Ratho	1841
	Craig, James, Holmes Farm, Moodiesburn	1850
670	Craig, William, C., Anneston, Biggar	1855
	Craigie, David, Banker, Perth	1842
	Craigie, Lawrence, of Glendoick	1824
	Cranston, James, Pathhead, Cockburnspath	1857
	Cranstoun, George Cranstoun Trotter, of Dewar	1849
	Craster, John, younger of Craster, Alnwick	1856
	Crawford, Adam, Rhodes, North Berwick.	1850
	Crawford, Alexander, Banker, Dunse	1853
	Crawford, Charles	1822
	Crawford, David, Writer, Greenock	1844
680	Crawford, James Coutts, of Overton	1855
	Crawford, John, of Auchinames	1818
	Crawford, John, Glenhead, Stranraer	1854
*	Crawford, William, of Doonside	1836
	Crawford, W. S. S., of Milton	1838
	Crawfurd, John	1819
	Craufurd, William Houison, of Craufurdland	1809
	Crerar, John, Bovain, Killin	1857
	Creyk, Dr Alexander, Pitchaish, Ballindalloch	1850
	Crichton, Charles J. Maitland Makgill, of Rankeillor,	1856
690	Crichton, Hew, Edinburgh	1838
	Crichton, Hew Hamilton, W.S.	1849
	Crichton, James Arthur, Advocate	1847
	Crichton, John, of Linn	1849
	Croall, John, Middlefield House, Edinburgh	1849
	Crombie, Alexander, of Thornton	1835
	Crosbie, Robert, of Kepp, Merchant, Liverpool	1845
	Cross, David, Seed-Merchant, Glasgow	1845
	Cross, Robert, Hilltown, Dalkeith	1852
	Cruickshank, Anthony, Aberdeen	1847
700	Cruickshank, George, Comisty, Huntly	1852
	Cruickshank, John, Barmuckitry, Elgin	1854
	Cruickshank, John, Cloves, Elgin	1852
	Crum, John, Thornliebank	1845
	Crum, Walter, of Thornliebank	1844

	Admitted
Cumine, James, of Rattray	1847
Cumming, Charles, Allanaquoich, Braemar	1851
Cumming, James, Dourie Bank, Port-William	1841
Cuninghame, Alexander, of Craigends	1844
Cuninghame, David, Chapelton, Ardrossan	1850
710 Cuninghame, Thomas Smith, of Caprington	1835
Cunningham, Alexander, of Balgonie	1841
Cunningham, Alexander, Morebattle. Tofts, Kelso	1841
Cunningham, Alexander, Rosebank, Currie	1854
Cunningham, John, Edinburgh	1849
Cunningham, John, of Lainshaw and Duchrae	1830
Cunningham, John Sinclair, Seed-Merchant, Edin.	1852
Cunningham, Thomas, Dallachy, Aberdour	1851
Cunningham, Thomas, Kirkettle, Roslin	1857
Cunningham, William A., of Logan	1836
720 Currie, Alexander, Advocate	1836
Currie, James, Halkerston, Fushie Bridge	1853
Currie, William, of Linthill	1832
Curror, Adam, Myreside, Burghmuirhead	1849
Curror, John, Comiston, Colinton	1848
Curry, Robert, Secretary of the Union Agricultural Society, Kelso	1851
Cuthbertson, Allan, Accountant, Glasgow	1844
Cuthbertson, Archibald, Greendykes, Tranent	1822
Cuthbertson, Donald, Accountant, Glasgow	1827
Cuthbertson, William, Merchant, Glasgow	1836
730 DECAZES, The Duc, Honorary Associate	1836
†DALHOUSIE, The Most Noble James, Marquis of, K.T.	1835
†DALKEITH, The Right Hon. William Henry Walter Montague Douglas Scott, Earl of, M.P.	1853
DUPPLIN, The Right Hon. George, Viscount	1853
DALRYMPLE, The Right Hon. John, Viscount	1845
DUNCAN, The Right Hon. Adam, Viscount, M.P.	1843
†DOUGLAS, The Right Hon. James, Lord	1849
†DUNFERMLINE, The Right Hon. James, Lord	1834
DOUGLAS, The Right Hon. Lord William R. Keith	1819
DUNDAS, The Right Hon. Sir David, of Ochtertyre	1846
740 DEAS, The Hon. Lord	1838
DUNBAR, Sir William, of Mochrum, Bart.	1845
DALRYMPLE, Sir Hew, of North Berwick, Bart.	1841
DUNBAR, Sir Archibald, of Northfield, Bart.	1839
DUNBAR, Sir George, of Hempriggs, Bart.	1839
DOUGLAS, Sir George Henry Scott, of Springwood Park, Bart.	1851

Admitted

DUNDAS, Sir David, of Dunira, Bart. 1828
DRUMMOND, Sir James Walker, of Hawthornden, Bart. 1834
DAVIE, Sir Henry R. Ferguson, of Creedy, Bart., M.P. 1848
DUNDAS, Vice-Admiral Sir Henry, K.C.B. 1842
750 Dale, John R., Auldhame, North Berwick 1851
Dalgairns, Lieutenant-Colonel, Ingliston 1841
Dalgleish, Archibald, Blanerne, Dunse 1854
Dalgleish, A. Stephenson, Merchant, Glasgow 1838
Dalgleish, Robert Bayne, of Dura 1848
Dallas, Alexander, Solicitor, Inverness 1853
Dalrymple, George A. F. Elphinstone, of Westhall 1855
Dalzell, James Allen, Seacliff 1835
Dalziel, James, Newhouse, Lanark 1854
Darling, William, Linplum, Haddington 1839
760 Darroch, Major Duncan, of Gourock 1840
Daubeney, Robert Henry, of Bristol 1826
Davidson, Adam, Nairn 1855
Davidson, Alexander, Mains of Cairnbrogie, Old Meldrum 1855
Davidson, Duncan, of Tulloch 1824
Davidson, George, Townhead, Balerno 1847
Davidson, Henry, Edinburgh 1848
Davidson, Henry M., Sheriff-Clerk of Haddingtonshire 1841
Davidson, Hugh, the Customs, Wick 1839
Davidson, John, Brathins, Banchory 1857
770 Davidson, Lawrence, W.S. 1829
Davidson, Patrick, of Inchmarlo 1834
Davidson, William, Oldhall, Thurso 1833
Davidson, William James, of Ruchill, Glasgow 1850
Davison, John, Trittington House, Morpeth 1852
Dawson, Adam, of Bonnyton 1851
Dawson, William, Mannerston, Linlithgow 1857
Dean, John, Mains of Balquhain, Keith Hall 1856
Deans, Henry, East Fenton, Haddington 1850
Deans, John, Penston, Gladsmuir 1841
780 Deans, Peter D., Penston, Gladsmuir 1850
Dempster, George, of Skibo 1823
Denholm, Alexander, Batelaws, Biggar 1854
Denholm, David, Cauldcoats, Libberton 1854
Dennistoun, Alexander, junior, Golfhill 1850
Dennistoun, John, Glasgow 1838
Dennistoun, Richard, Pinnacle Hill, Kelso 1855
Denny, Peter, of Castlegreen 1838

		Admitted
	Denoon, David, Merchant, London	1839
	Dewar, Major Alexander Cumming, Bengal Army	1832
790	Dewar, James, of Vogrie	1842
	Dick, Dr John, Broombank, Mid-Calder	1856
	Dick, William, Veterinary College, Edinburgh	1840
	Dick, William Douglas, of Pitkerro	1828
	Dickinson, Thomas, Magdalene Hall, St Boswells	1852
	Dickson, Alexander, Wheatlands, Kirkliston	1848
	Dickson, Archibald, Bughtrig, Coldstream	1854
	Dickson, Archibald, of Huntlaw	1823
	Dickson, David, Laurencekirk	1849
	Dickson, George, of Huntlaw	1830
800	Dickson, Henry Gordon, W.S.	1846
	Dickson, James Jobson, Accountant, Edinburgh	1850
	Dickson, John, of Peelwalls	1838
	Dickson, John, Saughton Mains, Slateford	1844
	Dickson, John, W.S., Perth	1846
	Dingwall, Walter, Inglismaldie, Laurencekirk	1849
	Dingwall, William, Ramornie, Ladybank	1851
	Dirom, Lieut.-Colonel John, of Mountannan	1838
	Dixon, Lieut.-Colonel H., Inverallan House, Grantown	1856
	Dixon, Thomas Griffies, Gifford Bank, Haddington	1849
810	Dixon, William, of Govanhill, Merchant, Glasgow	1827
	Dobie, John, Campend, Dalkeith	1850
	Dodd, Willam, Merchant, Glasgow	1837
	Dodds, John, Cranston Cottage, Dalkeith	1844
	Dods, William, Seed-Merchant, Haddington	1850
	Donald, William, Viewfield, Elgin	1854
	Donaldson, James, of Keppoch	1845
	Dougal, John, of Glenferness	1844
	Douglas, Alexander Forbes, Findarty, Kinross	1854
	Douglas, Archibald, of Glenfinart	1836
820	Douglas, Archibald Pringle, of Alderstone	1822
	Douglas, Francis Brown, Advocate	1839
	Douglas, James, Athelstaneford, Drem	1848
	Douglas, James, of Cavers	1835
	Douglas, John Campbell, of Mains	1850
	Douglas, Robert Johnstone, of Lockerbie	1842
	Douglas, Thomas Dunlop, of Dunlop	1838
	Douie, Andrew, Blair-Adam	1851
	Dove, John, Ecclesnewton, Kelso	1853
	Dove, William, Wark, Kelso	1845
830	Downie, Alexander, Merchant, Glasgow	1835

		Admitted
	Downie, John, Merchant, Glasgow	1838
	Drew, Laurence, Merryton, Hamilton	1850
	Drew, Peter, Carmyle, Tollcross, Glasgow	1854
	Drife, John, Barr, Sanquhar	1857
	Drimmie, Daniel, Panmure Bleachfield, Dundee	1843
	Drummond, Charles Home, Blair-Drummond	1852
	Drummond, George Home, yr. of Blair-Drummond	1835
	Drummond, Henry Home, of Blair-Drummond	1809
	Drummond, John, of Strageath	1854
840	Drummond, John Murray, of Megginch	1852
	Drummond, Thomas, of Newton	1828
	Drummond, William, Banker, Cupar-Fife	1837
	Drysdale, James, Seed-Merchant, Glasgow	1852
	Dudgeon, James, Fodderty, Dingwall	1850
	Dudgeon, John, Spylaw, Kelso	1840
	Dudgeon John, Almondhill, Kirkliston	1847
	Dudgeon, John B., Crakaig, Helmsdale	1856
	Dudgeon, Patrick, of Cargen	1851
	Dudgeon, Robert, Merchant, Liverpool	1828
850	Dudgeon, Robert, Humbie, Kirkliston	1849
	Dudgeon, William, Edinburgh	1826
	Duff, Rev. David, Minister of Kenmore	1839
	Duff, Garden, of Hatton	1814
	Duff, James, of Delgaty, M.P.	1840
	Duff, James Cunningham Grant, of Eden	1828
	Duff, Richard Wharton, of Orton	1805
	Duff, Robert, of Fetteresso	1823
	Duff, Thomas Abercromby	1835
	Dunbar, John, of Holme, Croy	1856
860	Dunbar, Lewis, Inverness	1856
	Dunbar, Lieutenant-Colonel P., London	1823
	Duncan, Alexander, of Providence, Rhode Island	1851
	Duncan, George, M.P. for Dundee	1843
	Duncan, George, Balchrystie, Colinsburgh	1838
	Duncan, James, Merchant, Leith	1826
	Duncan, John, Newseat of Tolquhon, Tarves	1855
	Duncan, Robert, Kirkmay, Crail	1855
	Duncan, William, S.S.C.	1848
	Dundas, George, Advocate, Sheriff of Selkirkshire	1846
870	Dundas, John, W.S.	1848
	Dundas, Robert, of Arniston	1847
	Dundas, Lieut.-Colonel Thomas, of Carronhall	1839
	Dunlop, Alexander Murray, of Corsock, M.P.	1828
	Dunlop, Archibald, London	1823
	Dunlop, Charles Tennant, St Rollox, Glasgow	1853

		Admitted
	Dunlop, George, Edinburgh	1849
	Dunlop, Henry, of Craigton	1838
	Dunlop, James, of Doonside	1844
	Dunlop, James, of Arthurlee	1844
880	Dunlop, John, of Brockloch	1836
	Dunlop, William, Redheughs, Corstorphine	1846
	Dunlop, William H., of Annanhill	1853
	Dunn, Adam, Tranent Mains, East Lothian	1854
	Dunn, William, Roxburgh Mains, Kelso	1853
	Dunsmure, James, Edinburgh	1817
	Durie, Robert Hogg, Standingstone, Haddington	1855
	Duthie, Alexander, Advocate, Aberdeen	1847
	Dyce, Major-General Alexander, H.E.I.C.S.	1855
	Dykes, Fretchville Lawson Ballantyne, of Devonby Hall, Cumberland	1845
890	Dyson, Thos. C., of Willowfield, Halifax, Yorkshire	1832
	ESTERHAZY, His Highness the Prince, Hungary, Honorary Associate	1836
	†EGLINGTON and WINTON, The Right Hon. Archibald, Earl of, K.T.	1834
	†ELGIN and KINCARDINE, The Right Hon. James, Earl of, K.T.	1842
	ERROL, The Right Hon. William Harry, Earl of	1854
	ELIBANK, The Right Hon. Alexander, Lord	1836
	ELCHO, The Right Hon. Francis, Lord, M.P.	1847
	ELPHINSTONE, The Right Hon. John, Lord	1834
	EMLYN, The Right Hon. John Fred., Viscount, M.P.	1839
900	ELPHINSTONE, The Hon. Mountstuart	1833
	ELLIOT, Sir William Francis, of Stobbs, Bart.	1823
	EDMONSTONE, Sir Archibald, of Duntreath, Bart.	1821
	ELPHINSTONE, Sir James Dalrymple Horn, of Horn and Logie-Elphinstone, Bart.	1840
	Eddington, Smollett Montgomery, of Glencreggan	1844
	Eddison, Edwin, Headingly Hill, Leeds	1850
	Edgley, Thomas, Gilmerton, Edinburgh	1857
	Edmonston, Thomas, of Buness, Zetland	1838
	Edward, Allan, Merchant, Dundee	1843
	Elder, James, Whitehill Mains, Libberton	1854
910	Elder, John, Merchant, Sleat	1815
	Elder, Thomas, Lenny Mains, Cramond	1854
	Ellice, Edward, yr. of Glenquoich, M.P.	1836
	Elliot, Adam, M.D., Goldielands, Hawick	1852

		Admitted
	Elliot, James, Lamberton, Berwick	1854
	Elliot, James, Gallalaw, Kelso	1853
	Elliot, John, Primrosehill, Dunse	1854
	Elliot, Robert, Laighwood, Dunkeld	1848
	Elliot, Robert Kerr, of Clifton	1849
	Elliot, Thomas, Hindhope, Jedburgh	1852
920	Elliot, Thomas, Blackhaugh, Selkirk	1854
	Elphinstone, James Anderson	1839
	Elphinstone, Col. James D. Fullerton, of Carberry	1855
	Elphinstone, Lieutenant-Colonel John	1827
	Embleton, John, Brownhouse, Berwick-on-Tweed	1854
	Errington, John Edward, Civil Engineer, London	1849
	Errington, Rowland, of Sandhoe	1841
	Erskine, Henry, Pitarrow, Laurencekirk	1851
	Erskine, James, of Shielfield, Melrose	1849
	Erskine, Thomas, of Linlathen	1843
930	Ewing, Alexander, Woodside Place, Glasgow	1844
	Ewing, Archibald Orr, Lennoxbank, Dumbarton	1851
	Ewing, James Lindsay, of Caldercruix	1844
	Ewing, John Orr, of Ratho	1838
	Ewing, Robert, Merchant, Greenock	1830
	Ewing, William Leckie, of Arngomery	1835
	†Fife, The Right Hon. James, Earl of, K.T.	1805
	Forbes, The Right Hon. Walter, Lord	1833
	Flahault, Charles, Count Mercer de	1821
	Forbes, Sir John Stuart, of Pitsligo and Fettercairn, Bart., Honorary Secretary of the Society	1830
940	Fergusson, Sir James, of Kilkerran, Bart., M.P.	1854
	Forbes, Sir Charles, of Newe and Edinglassie, Bart.	1828
	Forrest, Sir James, of Comiston, Bart.	1805
	Foulis, Sir William Liston, of Colinton, Bart.	1843
	Fair, James S. Elliot, of Langlee	1854
	Fairbairn, James, Auctioneer, Kelso	1850
	Fairlie, Lieutenant-Colonel James, of Holmes	1827
	Fairlie, James Ogilvie, of Coodham	1837
	Fairrie, John, Merchant, London	1831
	Fairweather, Robert, Craigend, Brechin	1855
950	Falconar, George, Kinloch	1835
	Falconer, Peter, Artrichie, Ellon	1851
	Falshaw, James, Civil Engineer, Nairn	1849
	Farie, James, of Farme	1850
	Farquhar, Arthur, of Elsick, W.S.	1852
	Farquhar, Nathaniel, Advocate, Aberdeen	1840

		Admitted
	Farquharson, Francis, of Finzean	1850
	Farquharson, Major-General Francis	1843
	Farquharson, Francis, Builder, Haddington	1856
	Farquharson, James, of Invercauld	1831
960	Farquharson, James, Auchinblae	1852
	Farquharson, Major John, of Corrachrie, Tarland	1841
	Farquharson, Robert, of Allargue	1845
	Fawcett, E. A., Sandford, Warcop, Westmoreland	1854
	Fell, William Edwin Cotton, Berners Street, Leith	1854
	Fenton, John, Mill of Mains, Dundee	1843
	Fergus, John, of Strathore, M.P.	1832
	Ferguson, Vice-Admiral George, of Pitfour	1828
	Ferguson, James, of Kinmundy	1826
	Ferguson, Lieut.-Colonel James	1831
970	Ferguson, James D., Newcastle-upon-Tyne	1852
	Ferguson, John, of Knockindale	1824
	Ferguson, John, Coynach, Ellon, Secretary, Buchan Agricultural Association	1847
	Ferguson, John, Burghlee, Loanhead	1848
	Ferguson, John, East Grange, Elgin	1855
	Ferguson, Lieut.-Colonel Robert, of Raith, M.P.	1845
	Fergusson, Adam, of Woodhill, Canada	1807
	Fergusson, John, of Kilquhanity, Castle Douglas	1846
	Fergusson, Muir, of Middlehaugh	1842
	Fergusson, Samuel R., London	1836
980	Fernie, James Blyth, of Kilmux	1836
	Fernie, John Carmichael, Balfarg, Markinch	1853
	Fettes, James, Surgeon, Laurencekirk	1850
	Findlay, Robert, of Easterhill, Glasgow	1838
	Findlay, Robert, Springhill, Bailieston, Glasgow	1855
	Findlay, Thomas Dunlop, Easterhill	1847
	Findlay, William, of Moss	1851
	Finlay, Alexander Struthers, of Castle Toward	1844
	Finnie, James, of Newfield	1853
	Finnie, John, Swanston, Burghmuirhead	1838
990	Fisher, Daniel, S.S.C.	1819
	Fisher, James, M.D.	1821
	Fleeming, John Elphinstone, of Cumbernauld	1851
	Fleming, Alexander, Avon Mills, Hamilton	1850
	Fleming, Andrew, Mains of Fullwood, Paisley	1852
	Fleming, Colonel, of Kinlochlaich	1839
	Fleming, James, Three-Mile-Town, Linlithgow	1854
	Fleming, James, Coats, Penicuik	1857
	Fleming, John, Ballindalloch	1857
	Flemying, Robert Stewart	1826

		Admitted
1000	Fletcher, Angus, of Dunans	1826
	Fletcher, Angus, Sculptor	1842
	Fletcher, Archibald, Tyndrum	1857
	Fletcher, Major C. E.	1848
	Fletcher, Dugald, Ballachindrain, Cairndow	1853
	Forbes, Alexander, of Boyndlie	1840
	Forbes, Arthur, of Culloden	1850
	Forbes, Arthur, W.S.	1850
	Forbes, Charles Henry, of Kingerloch	1836
	Forbes, Charles William, Moniach Castle, Inverness	1856
1010	Forbes, Dugald, Writer, Glasgow	1847
	Forbes, Duncan, of Leanachs and Balvraid	1850
	Forbes, George, Banker, Edinburgh	1817
	Forbes, George, Merchant, London	1830
	Forbes, George, Wine-Merchant, Edinburgh	1835
	Forbes, James D., Professor of Natural Philosophy, University of Edinburgh	1836
	Forbes, James Stewart, Edinglassie, Strathdon	1830
	Forbes, Captain John, of Inverernan	1842
	Forbes, John, of Haddo	1850
	Forbes, Patrick, of St Catherine's	1834
1020	Forbes, William, of Medwyn, Advocate	1835
	Forbes, William, Newark, Ellon	1852
	Ford, William, Craigmillar, Edinburgh	1849
	Fordyce, Captain Alexander Dingwall, of Brucklay	1847
	Forlong, William, of Erins	1838
	Forman, John Nairne, W.S.	1831
	Forman, Robert, Windymains, Blackshiels	1852
	Forrest, Archibald, Hole of Kilncadzow, Lanark	1855
	Forrest, James, junior, Kirriemuir	1843
	Forrest, William, of Treesbanks, Hamilton	1850
1030	Forrester, John, W.S.	1842
	Forrester, William, Stewarthall, Stirling	1850
	Forrester, William, Lithographer, Edinburgh	1851
	Forrester, William, Wedderburn Mains, Dunse	1854
	Forrester, W. A., of Barns	1842
	Forsyth, James, of Dunach	1838
	Forsyth, John, Arabella, Parkhill, Tain	1855
	Forteath, George A., of Newton, Elgin	1854
	Fortune, William R., of Muircambus, Colinsburgh	1854
	Foulds, William, of Skirnieland	1833
1040	Fowler, Henry Mackenzie, of Raddery	1846
	Fowler, Andrew, Seed Merchant, Glasgow	1855
	Fox, Michael, junior, Glencorse Mains, Penicuik	1849
	Fox, Richard M., of Foxhall, Rathowen, Ireland	1838

		Admitted
	Fraser, Affleck, Inverness	1840
	Fraser, Alexander, City Chamberlain, Aberdeen	1841
	Fraser, Colonel Alexander, Royal Engineers	1818
	Fraser, Andrew, W.S., Sheriff-Sub., Fort-William	1840
	Fraser, Archibald Thomas Frederick, of Abertarff	1820
	Fraser, Col. Charles, of Inverallochy & Castle Fraser	1816
1050	Fraser, Evan Baillie, Inverness	1840
	Fraser, Hugh, Abersky, Inverness	1840
	Fraser, Hugh, Balloch of Culloden, Inverness	1853
	Fraser, Hugh, Calcutta	1856
	Fraser, James, Muirfield, Inverness	1854
	Fraser, John, London	1840
	Fraser, John, of Bunchrew, Inverness	1856
	Fraser, Patrick Allan, of Hospitalfield, Arbroath	1854
	Fraser, Robert, Brackla, Nairn	1839
	Fraser, Sweton, Auchernick, Grantown	1854
1060	Fraser, Lieut.-Col. Thomas, of Balnain	1839
	Fraser, William, of Glenmead, W.S.	1816
	Fraser, William, Bone Mills, Broxburn	1857
	Fraser, William, junior, W.S.	1837
	Fraser, William, of Culbokie	1852
	Fraser, William Sutherland, Banker, Dornoch	1850
	Freeland, Robert, of Gryffe Castle	1835
	French, James, Lampits, Carnwath	1855
	French, James, M.D., C.B., F.R.G.S.	1853
	Friar, Thomas, of Grinden Ridge, Etal	1854
1070	Fullarton, Gavin, of Kerelaw	1844
	Fullerton, Archibald, of Kilmichael	1846
	Fullerton, Captain James	1824
	Fullerton, William, Mains of Ardestie, Dundee	1852
	Fyfe, Andrew, M.D., Professor of Chemistry, King's College, Aberdeen	1823
	Fyfe, John, of Dalmarnoch	1847
	GORDON, Her Grace Elizabeth, Duchess of	1834
	†GALLOWAY, The Right Hon. Randolph, Earl of	1830
	†GLASGOW, The Right Hon. James, Earl of	1822
	GIFFORD, The Right Hon. George, Earl of, M.P.	1846
1080	GRAY, The Right Hon. John, Lord	1821
	GRAHAM, The Right Hon. Sir James Robert George, of Netherby, Bart., M.P.	1830
	GORDON, Vice-Admiral The Hon. William	1824
	GLADSTONE, Sir Thomas, of Fasque, Bart.	1834
	Gairdner, Charles Dalrymple, Auchans, Dundonald	1853
	Galbraith, Alexander, Merchant, Glasgow	1850

		Admitted
	Galbraith, Andrew, Merchant, Glasgow	1850
	Galbraith, David Stewart, late of Mackrihanish	1812
	Galbraith, William, of Blackhouse, Sheriff-Clerk of Stirlingshire	1822
	Galloway, Alexander, Land-Agent, Glasgow	1850
1090	Garden, John, Mill of Ardlethen, Ellon	1851
	Garden, William, M.D., Balfluig, Aberdeen	1850
	Garden, William, Braco Park, Fraserburgh	1857
	Gardner, Hamilton Gray, W.S.	1844
	Gardner, John, of Springbog	1844
	Gardner, Robert, Traquair Knowe, Innerleithen	1855
	Gardner, R., City of Glasgow Bank, Whitburn	1855
	Gardiner, A. F., Overseer, Milnegraden, Coldstream	1853
	Gardiner, James, Lanton, Ratho	1855
	Gardiner, Richard, of Dudhope	1841
1100	Garland, John, Cairnton, Laurencekirk	1849
	Garland, Thomas, junior, Ardlethen, Ellon	1851
	Gartshore, John Murray, of Gartshore	1825
	Gatherer, George, Writer, Elgin	1854
	Gebbie, William, of Hazeldean, Strathaven	1853
	Geddes, Adam G., Edinburgh	1819
	Geddes, James, Orbliston, Fochabers	1843
	Geddes, Major-General John, K.G.	1842
	Geekie, Alexander, of Baldourie	1837
	Geekie, Peter, Balboughty, Perth	1837
1110	Geekie, Robert, of Rosemount	1843
	Geils, John Edward, of Dumbuck	1844
	Gentle, Robert, Dell, Inverness	1840
	Gerard, Archibald, of Rochsoles	1842
	Gibb, David, Bridge of Dye, Banchory Ternan	1855
	Gibbon, Alexander, of Johnston	1834
	Gibbons, Edward, Portree, Skye	1830
	Gibbs, B. T. Brandreth, London	1849
	Gibson, John, W.S.	1825
	Gibson, John, jun., W.S.	1828
1120	Gibson, John, Woolmet, Dalkeith	1847
	Gibson, John, Eastfield, Wiston, Biggar	1853
	Gibson, Thomas, of Spittal, M.D., Rothesay	1845
	Gibson, William, Lochrin Mills, Edinburgh	1854
	Gilchrist, Daniel, of Ospisdale, Dornoch	1841
	Giles, James, of Kailzie	1812
	Gilbert, John Graham, of Yorkhill	1847
	Gilkison, Robert, jun., Glasgow	1848
	Gillanders, F.M., of Newmore	1844
	Gillanders, James F., of Highfield	1854

		Admitted
1130	Gillespie, Alexander, M.D., Edinburgh	1806
	Gillespie, Alexander, Merchant, London	1836
	Gillespie, David, of Mountquhannie	1841
	Gillespie, James, Craigie, Cramond	1849
	Gillespie, James, Annanbank, Lockerby	1850
	Gillespie, John, W.S.	1846
	Gillespie, Robert, Merchant, London	1829
	Gillespie, Robert, of Cambus-Wallace	1842
	Gillespie, Thomas, Parkhall, Douglas	1842
	Gillespie, Thomas, Ardochy, Fort Augustus	1821
1140	Gillon, Andrew, of Wallhouse	1848
	Gilmour, Allan, of Eaglesham	1849
	Gilmour, Walter James Little, of Craigmillar	1828
	Girdwood, John, London	1845
	Girdwood, Robert, Edinburgh	1855
	Girdwood, Samuel, Little Kilmory, Rothesay	1855
	Gladstone, Robertson, Merchant, Liverpool	1841
	Gladstone, Thomas Stewart, of Capenoch	1853
	Glasgow, Alexander, of Old Court, Cork	1847
	Glasgow, R. Robertson, of Montgreenan, Sheriff-Substitute of Renfrewshire	1838
1150	Glen, John, Merchant, Edinburgh	1847
	Glen, Thomas, Hillhead, Paisley	1853
	Glen, William, Hawkhead Mains, Paisley	1850
	Glendinning, George, Hatton Mains, Ratho	1849
	Glendinning, Peter, Dalmeny Park, Queensferry	1848
	Glendinning, Robert W., Browndykes, Ayton	1854
	Glennie, Arthur, Fernyflat, Bervie	1851
	Good, Peter, Firth, Roslin	1857
	Goodlet, William, Beauchamp, Arbroath	1851
	Goodsir, John, Professor of Anatomy, University of Edinburgh	1846
1160	Goodwin, Lieut.-Colonel Hugh Maxwell, of Mount Alyn, Denbighshire	1830
	Gordon, Alexander, of Ellon	1808
	Gordon, Alexander, of Newton	1841
	Gordon, Charles, of Auchleuchries	1832
	Gordon, Vice-Admiral Charles, R.N.	1835
	Gordon, Charles Napier, of Esslemont	1840
	Gordon, Edward Stratherne, Advocate, Edinburgh	1840
	Gordon, Francis, of Craig	1835
	Gordon, George, America	1829
	Gordon, Harry George, of Killiechassie	1855
1170	Gordon, James, of Manar	1835

		Admitted
	Gordon, James, of Ivy Bank	1813
	Gordon, James, of Xeres-de-la-Frontera	1834
	Gordon, John, of Avochie	1846
	Gordon, Colonel John, of Cluny	1807
	Gordon, John, of Cairnbulg	1811
	Gordon, John, of Aikenhead	1-38
	Gordon, John, Lettoch, Glenlivet	1853
	Gordon, Colonel John, R. A., Culdrain, Gartly	1850
	Gordon, John, Ballintomb, Grantown	1856
1180	Gordon, John Taylor, of Nethermuir	1831
	Gordon, John Thomson, Sheriff of Edinburgh	1841
	Gordon, Michael Francis, of Abergeldie	1831
	Gordon, Peter Charles, of Wardhouse	1834
	Gordon, Peter Laing, of Craigmyle	1834
	Gordon, Richard, Accountant, Edinburgh	1845
	Gordon, Robert, of Jamaica	1802
	Gordon, Robert Macartney, of Rattra	1846
	Gordon, William, of Culvennan	1845
	Gordon, William, Aberdeen	1847
1190	Gordon, Captain William Cosmo, of Fyvie	1847
	Govan, John, W.S.	1809
	Gow, James, Bankend, Denny	1854
	Gow, John L., Raith, Kirkcaldy	1851
	Gracie, John, Castlehill, Peebles	1855
	Græme, Robert, of Wellhall, Hamilton	1853
	Graham, Alexander, Summerston, East Kilpatrick	1854
	Graham, Alexander, of Capilly	1844
	Graham, Frederick, Edinburgh	1821
	Graham, George	1817
1200	Graham, George, of Shaw	1826
	Graham, Henry, Possil, Glasgow	1855
	Graham, Humphrey, W.S.	1819
	Graham, James	1827
	Graham, James, of Fereneze	1843
	Graham, James, Meikle Culloch, Dalbeattie	1851
	Graham, James Maxwell, Glasgow	1844
	Graham, John, Pearsie, Kingoldrum	1843
	Graham, John, younger of Shaw	1852
	Graham, Robert, of Redgorton	1817
1210	Graham, Robert, Merchant, Leith	1826
	Graham, Robert C. Cunningham, of Gartmore	1823
	Graham, Thomas, of Ballewan, M.D., F.R.S., Master of the Mint, London	1849
	Graham, Thomas, younger of Balfunning	1851

		Admitted
	Graham, William, Writer, Glasgow	1828
	Graham, Colonel William, of Mossknow	1834
	Graham, William, jun., of Finnartmore	1844
	Graham, William, of Devonshaw, Dollar	1854
	Graham, William, jun., Lairg	1855
	Graham, William Stirling, of Airth	1833
1220	Grahame, Barron, of Morphie	1853
	Grainger, John, Harestanes, Jedburgh	1836
	Grant, Archibald, younger of Monymusk	1854
	Grant, Major Charles, Aberdeen	1816
	Grant, Duncan, of Bught	1825
	Grant, George, Liverpool	1840
	Grant, George, of Limepots, Advocate, Sheriff-Substitute of Fifeshire	1846
	Grant, Hay Macdowall, of Arndilly	1852
	Grant, Rev. James, D.D., and D.C.L., Chaplain to the Society	1828
	Grant, James Augustus, of Viewfield	1840
1230	Grant, James Murray, of Glenmorriston and Moy	1810
	Grant, John, of Kilgraston	1819
	Grant, John, Glengrant, Elgin	1854
	Grant, John, Arbeadie, Banchory	1857
	Grant, John Peter, W.S.	1823
	Grant, Kenneth, Kinnellan, Dingwall	1853
	Grant, Patrick, W.S., Sheriff-Clerk of Inverness-shire	1836
	Grant, Peter, Weirach, Ballindalloch	1852
	Grant, Robert, of Kincorth	1826
	Grant, Robert, of Tillyfour	1830
1240	Grant, Robert, of Druminner	1841
	Grant, Thomas Macpherson, of Craigo, W.S.	1846
	Grant, Walter Colquhoun	1844
	Grant, William, younger of Elchies	1833
	Grant, William, Australia	1839
	Grant, William Forsyth, of Ecclesgreig	1849
	Grant, W. P., of Rothiemurchus	1821
	Grassick, Charles	1830
	Grassick, John, Mains of Glenbucket, Strathdon	1829
	Grassick, Patrick, Glenlogie, Forbes	1842
1250	Gray, Andrew Farquhar, of Glentig	1835
	Gray, Charles, Distiller, Glasgow	1838
	Gray, Donald, Corrish, Golspie	1856
	Gray, Dr Dundas Macqueen, of Crofton Hill, Lanark	1856

		Admitted
	Gray, James, Bearside, Stirling	1851
	Gray, John, Merchant, Greenock	1831
	Gray, John, Edinburgh	1848
	Gray, John, Uddingston, Glasgow	1856
	Gray, Patrick, Broadyetts, Uphall	1854
	Gray, Roderick, Peterhead	1829
1260	Gray, Stephen, of Mansfield	1838
	Gray, Thomas, Coul, Markinch	1854
	Gray, William, Kingston, North Berwick	1849
	Gray, William, Southfield, Portobello	1849
	Gray, William, Brownrigg, Drem	1855
	Green, William, Ruthrie, Craigellachie	1857
	Greenhill, David, Meikleour House, Perth	1842
	Greenshields, John, of Kerse	1829
	Greg, John, Oatfield, Campbeltown	1850
	Gregory, Alex. Allan, Milburn, Inverness	1854
1270	Gregory, Arthur Thomas, of Buchromb	1833
	Gregory, William, M.D., Professor of Chemistry, University of Edinburgh	1845
	Greig, James, of Eccles, W.S.	1809
	Greig, John Rutherford, of Lethangie	1833
	Greig, John, younger of Lethangie	1846
	Greig, Thomas, of Glencarse	1852
	Gregorson, Angus, Banker, Oban	1851
	Grey, George A., Millfield Hill, Wooler	1854
	Grierson, James, Caigton, Castle-Douglas	1851
	Grierson, James, of Dalgoner	1855
1280	Grieve, Robert, Laudle, Strontian	1857
	Grieve, Robert, Morenish, Killin	1857
	Grieve, William, of Branxholm Park, Hawick	1834
	Grieve, William, Shelfield, Hawick	1854
	Grigor, John, Forres Nurseries, Forres	1847
	Gulland, James, Newton of Wemyss, Kirkcaldy	1851
	Gulland, William Erskine, of Stripeside	1833
	Gulston, A. J., of Combe Royal, Kingsbridge,	1856
	Gunn, Alexander, Dalemore, Thurso	1850
	Gunn, Alexander, Dornoch	1856
1290	Gunn, George, Rhives, Golspie	1821
	Gunn, James, Glendhu, Golspie	1839
	Gunn, Marcus, Culgower, Golspie	1849
	Gunn, William, Glendhu, Golspie	1839
	Guthrie, David, Edinburgh	1850
	Guthrie, David, Banker, Stranraer	1854
	Guthrie, George, Rephad, Stranraer	1839

Admitted

Guthrie, John, of Guthrie 1836
Guthrie, John, Holms, Kilmarnock 1857
Guthrie, Robert, Crossburn, Troon 1857
1300 Gwynne, Alban Thomas Jones, of Monachty, Cardiganshire 1834

*HAMILTON and BRANDON, His Grace William Anthony Alexander, Duke of, President of the Society 1834
HUNTLY, The Most Noble Charles, Marquis of 1819
†HOME, The Right Hon. Cospatrick, Earl of 1843
†HADDINGTON, The Rt. Hon. Thomas, Earl of, K.T. 1804
HOPETOUN, The Right Hon. John Alex., Earl of 1853
HADDO, The Right Hon. George, Lord 1848
HAY, Lieut.-General The Right Hon. Lord James 1847
HALLYBURTON, The Right Hon. Lord John Frederick Gordon, of Pitcur 1844
HAMILTON, The Right Hon. R. C. N., M.P. 1825
1310 HOPE, The Right Hon. John, Lord Justice-Clerk 1823
HOPE, Sir Archibald, of Pinkie, Bart. 1832
HANDYSIDE, The Hon. Lord 1841
HAY, Sir Adam, of Smithfield and Hayston, Bt. 1825
HAY, Sir James Dalrymple, of Park Place, Bt. 1816
HALL, Sir John, of Dunglass, Bart. 1829
HEPBURN, Sir Thomas Buchan, of Smeaton, Bt. 1837
HOUSTOUN, General Sir Robert, of Clerkington, K.C.B. 1833
HAY, Sir Andrew Leith, of Rannes 1819
Hadden, Alexander, Aberdeen 1840
1320 Hadwen, Sidney, Kildonan Lodge, Golspie 1854
Hagart, Thomas, of Bantaskine 1826
Haggart, James Valentine, of Glendelvine 1844
Haig, Andrew, Meikle Kilmory, Rothesay 1855
Haig, J. A., Stage Hall, Stow 1855
Haig, John, Cameron House, Kirkcaldy 1841
Hall, Andrew, Braerich, Golspie 1855
Hall, Henry, Coul, Dornoch 1846
Hall, James, younger of Dunglass 1849
Hall, John, Scibercross, Golspie 1841
1330 Hall, John, of Mollance 1841
Hall, Colonel Thomas, of Killean 1853
Hamilton, Hugh, of Pinmore 1853
Hamilton, James, of Whiteshaw Gate, Avondale 1850
Hamilton, John, of Sundrum 1839

		Admitted
	Hamilton, John, of Fairholm	1827
	Hamilton, John, of Greenbank	1846
	Hamilton, John Buchanan, of Leny and Bardowie	1846
	Hamilton, Lt.-Colonel John Ferrier, of Westport	1827
	Hamilton, Robert, W.S., Teretigan, Tarbert	1842
1340	Hamilton, Robert William, Edinburgh	1814
	Hamilton, Walter Ferrier, younger of Westport	1848
	Hamilton, William, Merchant, Glasgow	1823
	Hamilton, William C., of Craighlaw	1852
	Handyside, William, Cornhill, Biggar	1843
	Hannam, John, Secretary Yorkshire Agricultural Society, Kirk Deighton, Wetherby	1854
	Harden, Robert Allan, Edinburgh	1838
	Hardie, George, Australia	1851
	Hardie, Robert, Harrietfield, Kelso	1851
	Hare, Steuart Bayley, of Calderhall	1849
1350	Harkness, Thomas, Roxeth Villa, Harrow on the Hill	1855
	Harland, Wm. Chas., of Sutton Hall, York	1852
	Harper, Frank, Dingwall	1853
	Harper, Robert, Edmonston Mains, Dalkeith	1857
	Harrop, Isaac W., Edinburgh	1846
	Harvey, Arthur, Tillygreig, Aberdeen, Secretary Royal Northern Agricultural Society	1838
	Harvey, C. W., Merchant, Liverpool	1846
	Harvey, George, Whittingham Mains, Prestonkirk	1850
	Harvey, James H., Pitgersie, Foveran, Ellon	1854
	Harvey, John, of Tiningly Park, Yorkshire	1809
1360	Harvey, John Inglis, of Kinnettles, H.E.I.C.S.	1845
	Harvey, Robert, of Pennygowan	1845
	Harvey, William James, of Carnousie	1851
	Harvie, Robert, Distiller, Port-Dundas	1838
	Harvie, Rev. William, of Brownlee, Carluke	1852
	Hastie, Alexander, M.P. for Glasgow	1843
	Hastie, Archibald, M.P. for Paisley	1838
	Hay, Adam, W.S.	1846
	Hay, George William, of Whiterigg	1841
	Hay, James, Little Ythsie, Ellon	1852
1370	Hay, James, Merchant, Leith	1828
	Hay, James, Nether Mill of Tillyhilt, Tarves	1855
	Hay, John, of Letham Grange	1834
	Hay, Captain John Chas. D., yr. of Park Place	1848
	Hay, John Stewart	1836

	Admitted
Hay, Robert, Rechleirach, Ballindalloch	1852
Hay, Samuel, Manager Union Bank of Scotland	1846
Hay, William, of Hayfield	1828
Hay, William, of Dunse Castle	1819
Hay, William, of Hopes	1835
1380 Hay, William, Chapel, Drem	1853
Heathcot, John, Honorary Member	1837
Hector, Alexander, Writer, Edinburgh	1824
Hector, Robert, Kintrockat, Brechin	1848
Henderson, Alexander, Longniddry, Tranent	1837
Henderson, Alexander, Gourdie House, Dunkeld	1843
Henderson, Alexander, younger of Stemster	1847
Henderson, Charles, Abbotrule, Bonchester Bridge	1854
Henderson, Charles J., Corn Merchant, Leith	1847
Henderson, David, Abbotrule, Bonchester Bridge	1854
1390 Henderson, Captain David, of Stemster	1829
Henderson, David, of Gattaway, Newburgh	1850
Henderson, Duncan, M.D.	1825
Henderson, George, East Gordon, Kelso	1854
Henderson, G. D. Clayhills, Hallyards, Perthshire	1843
Henderson, James, Auchincorth, Penicuik	1854
Henderson, James, of Bilbster	1839
Henderson, James, Islay	1851
Henderson, John, Abbotrule, Bonchester Bridge	1854
Henderson, John, Middlethird, Kelso	1854
1400 Henderson, John, Byres, Haddington	1850
Henderson, John, W.S., Banker, Thurso	1839
Henderson, John, of Park	1838
Henderson, Major John Alexander, of Westerton	1831
Henderson, John Irving, Advocate, Sheriff-Substitute, Dundee	1823
Henderson, Robert, Abbotrule, Bonchester Bridge	1854
Henderson, Thomas, Newton, Musselburgh	1854
Henderson, William, Craigairnhall, Stirling	1851
Henderson, William Scott, W.S.	1850
Hepburn, John Buchan, of Castle Dykes	1845
1410 Hepburn, John Stewart, of Colquhalzie	1810
Hepburn, R. W. R., of Riccarton	1849
Heriot, Frederick L. Maitland, of Ramornie	1851
Herries, William Young, of Spottes	1823
Herries, Alexander Young, younger of Spottes	1853
Hernulewicz, Edward, Glasgow	1855
Hewatson, Robert, Auchenbenzie	1834
Hewetson, Walter, Kirkhouse, Kirkbean	1851

		Admitted
	Hill, David, Bannatyne House, Newtyle	1852
	Hill, George Gosset, Merchant, London	1823
1420	Hill, Henry David, W.S.	1825
	Hill, James Lawson, W.S.	1847
	Hill, John, Easter Carlowrie, Kirkliston	1850
	Hill, Lawrence, Writer, Glasgow	1838
	Hill, Robert, Golspie Tower Farm, Golspie	1851
	Hislop, John, Black Craig, New Cumnock	1856
	Hislop, Robert, jun., Prestonpans	1854
	Hobbs, Wm. Fisher, of Boxted Lodge, Colchester	1848
	Hodgson, Richard, of Carham, Northumberland	1850
	Hogarth, George, Banker, Cupar-Fife	1842
1430	Hogarth, John, Akeld, Northumberland	1841
	Hog, James Maitland, of Newliston	1835
	Hogg, Thomas, Hillhouse, Coldstream	1854
	Holmes, James, of Kirkstyle, Dalserf	1850
	Home, David Milne, of Wedderburn, Advocate	1835
	Home, Francis, Sheriff-Substitute, Linlithgow	1829
	Home, G. H. Binning, of Argaty	1831
	Home, Major-General J. H., of Bassendean	1834
	Home, Major George Logan, of Broomhouse	1852
	Hood, Charles, Inverbrora, Golspie	1856
1440	Hood, David, Hatton, Glammis	1834
	Hood, John, of Stoneridge	1827
	Hood, Thomas, Cove, Cockburnspath	1854
	Hope, Andrew, Hill Street, Edinburgh	1851
	Hope, George, Fenton Barns, Drem	1848
	Hope, Geo. William, of Luffness and Rankeillor	1848
	Hope, James, Duddingston, Portobello	1847
	Hope, James, of Belmont, W.S.	1848
	Hope, John, South Elphinstone, Tranent	1851
	Horn, John, of Thomanean	1837
1450	Horn, Robert, Advocate	1851
	Horne, Archibald, of Inverchroskie, Auditor of Accounts to the Society	1828
	Horne, Donald, of Langwell, W.S.	1817
	Horne, James, Civil Engineer, Edinburgh	1848
	Horne, Major James, younger of Langwell	1846
	Horne, Thomas Elliot Ogilvie, W.S., Edinburgh	1851
	Horrocks, John	1818
	Horsburgh, Robert, House of Tongue	1841
	Horsburgh, Major William Henry	1824
	Hosack, William, Dochcarty, Dingwall	1853
1460	Hotchkis, James, Dumfries	1838

		Admitted
	Houldsworth, John, Merchant, Glasgow	1838
	Houston, Ludovick, of Johnstone Castle	1823
	Houstoun, Lieut-Colonel A., yr. of Clerkington	1845
	Houstoun, William, Kintradwell, Golspie	1854
	Howard, Lieut.-Colonel	1809
	Howat, Robert Kirkpatrick, of Mabie	1841
	Howden, Francis, Falkland	1842
	Howden, Robert, Boggs, Pencaitland	1850
	Howden, James, Jeweller, Edinburgh	1827
1470	Howe, Alexander, W.S.	1854
	Hoyes, James, Kineddar, Elgin	1854
	Hoyle, Duncan, of Kames	1855
	Hozier, James, of Newlands	1822
	Hubback, Joseph, Liverpool	1853
	Hubback, Thomas, Sunlawshill, Kelso	1851
	Huggins, W. B., Glasgow	1844
	Hughan, Thomas, of Airds	1838
	Hume, M. N. Macdonald, of Ninewells, W.S.	1818
	Hume, P. Hallyburton, Lawfield, Cockburnspath	1840
1480	Hume, Thomas, Thirlstane, Lauder	1854
	Hunt, James, of Pittencrieff	1836
	Hunt, James Alexander, of Chamberfield	1849
	Hunt, William, younger of Pittencrieff	1836
	Hunter, Alexander, St Colmac, Rothesay	1855
	Hunter, Alexander, W.S.	1824
	Hunter, Alexander, Nethershiel, Ratho	1855
	Hunter, Charles	1823
	Hunter, David, of Blackness	1826
	Hunter, Captain James, N.B. Staff, Edinburgh	1847
1490	Hunter, James, Edinburgh	1823
	Hunter, Captain James, of Auchterarder	1823
	Hunter, James, of Auldhouseburn	1852
	Hunter, James William, of Thurston	1842
	Hunter, John, Oxenford Mains, Ormiston	1842
	Hunter, John, New Banchory, Banchory	1857
	Hunter, Philip, Edinburgh	1856
	Hunter, Richard, H.E.I.C.S.	1837
	Hunter, Robert, Glenocher, Abington	1842
	Hunter, Robert, Sheriff of Bute and Dumbarton	1843
1500	Hunter, Robert, Dalhousie Chesters, Lasswade	1854
	Hunter, William, Haugh, Kirkliston	1853
	Hunter, William King, of Stoneshiehall, Dunse	1854

		Admitted
	Hutcheson, James, Ingliston, Dumfries	1857
	Hutchinson, James, Merchant, Glasgow	1838
	Hutchison, Graham, Merchant, Glasgow	1838
	Hutchison, John, Monyruy, Peterhead	1841
	Hutchison, Robert, Merchant, Glasgow	1838
	Hutchison, Robert, of Cairngall	1829
	Hutchison, Robert, of Carnock, Kirkcaldy	1850
1510	Hutton, Thomas, Bridgeton, Montrose	1844
	Ivory, The Hon. Lord	1833
	Innes, Sir James Milne, of Edingight, Bart.	1838
	Inch, John, West Mains, Liberton	1855
	Inglis, Charles Craigie Halkett, of Cramond	1834
	Inglis, Harry Maxwell, of Logan Bank, W.S.	1847
	Inglis, Henry, W.S.	1849
	Inglis, James P.	1806
	Inglis, John, Dean of the Faculty of Advocates	1852
	Inglis, Lieut.-Colonel Hugh, of Kingsmills, Inverness	1856
1520	Inkson, Patrick, Berryless, Ballindalloch	1857
	Innes, Alexander, of Cowie	1840
	Innes, Alexander Mitchell, younger of Ayton	1842
	Innes, Cosmo, Principal Clerk of Session	1840
	Innes, George Mitchell, of Ingliston and Bangour	1847
	Innes, John B., W.S.	1847
	Innes, Thomas, of Lairney	1846
	Innes, Thomas Mitchell, of Phantassie	1842
	Innes, William Mitchell, of Ayton	1819
	Innes, William, of Raemoir	1834
1530	Irvine, Alexander Forbes, of Drum	1805
	Irvine, Alexander Forbes, younger of Drum	1845
	Irvine, Rev. A. Robertson, Blair-Atholl	1838
	Irvine, William Stewart, M.D., Pitlochrie	1843
	Irving, George Vere, of Newton	1844
	Irving, John, London	1838
	Irving, William, New Steadings, Lanark	1855
	Johnstone, The Hon. Henry Butler, of Corehead	1842
	Jardine, Sir William, of Applegarth, Bart.	1823
	Johnston, Sir William, of Kirkhill	1848
1540	Jack, Gavin, Dreghorn Mains, Colinton	1854
	Jack, Robert, West Craigs, Corstorphine	1854
	Jack, Robert, West Nemphlar, Lanark	1855

		Admitted
	Jameson, Melville, Writer, Perth	1852
	Jardine, Andrew, of Lanrick	1846
	Jardine, Alexander, younger of Applegarth	1850
	Jardine, James, Civil Engineer, Edinburgh	1818
	Jardine, James, of Larreston	1846
	Jardine, John, Arkleton, Langholm	1854
1550	Jeffrey, John, Glasgow	1857
	Jeffreys, Captain George, of Sunwick, Berwick	1840
	Jobling, Joseph, Implement-maker, Coldstream	1854
	Jobson, William, Turvelaws, Wooler	1855
	Johnson, George, Springfield, Forres	1857
	Johnston, Alexander, W.S.	1836
	Johnston, Alex., Hailes, Slateford	1852
	Johnston, Alex., of Cormiston, Biggar	1855
	Johnston, George, Irvine	1822
	Johnston, George, Marlefield, Kelso	1853
	Johnston, James, Capplegill, Moffat	1854
1560	Johnston, James, Letham Mains, Haddington	1856
	Johnston, John	1833
	Johnston, John, Union Street, Glasgow	1856
	Johnston, John, Mill of Hirn, Banchory	1857
	Johnston, John, Ballencrieff Mains, Bathgate	1852
	Johnston, John, Crailinghall, Jedburgh	1853
	Johnston, Robert, Merchant, Aberdeen	1839
	Johnston, William, of Lathrisk	1849
	Johnston, William, Writer, Bathgate	1852
	Johnstone, Alexander, W.S.	1819
1570	Johnstone, Andrew, of Halleaths	1838
	Johnstone, Charles Kinnaird, K.L.S.	1839
	Johnstone, Christopher, Townfoot, Dumfriesshire	1850
	Johnstone, James, of Alva, M.P.	1828
	Johnstone, John James Hope, of Annandale, M.P.	1824
	Jollie, Walter, W.S.	1829
	Jolly, David Leitch, Banker, Perth	1829
	Jolly, William Gairdner, Catter, Drymen	1845
	Jopp, Alexander, Advocate, Aberdeen	1834
	KINTORE, The Right Hon. Francis A., Earl of	1850
1580	†KINNOULL, The Right Hon. Thomas, Earl of	1806
	†KINNAIRD, The Right Hon. George Wm, Lord	1830
	KENNEDY, The Right Hon. T. F., of Dunure	1812
	KINLOCH, Sir David, of Gilmerton, Bart.	1828
	Kay, James, Gargunnock, Stirling	1854

		Admitted
	Kaye, Robert, of Millbrae	1844
	Keir, Andrew T., Noss, Wick	1844
	Keir, Patrick Small, of Kinmonth	1805
	Keir, Patrick, younger of Kinmonth	1837
	Keir, Simon, Ceylon	1857
1590	Kelk, George, Braehead House, Kilmarnock	1853
	Kemp, John A., yr. of Hallydown	1852
	Kennedy, Charles Storr, Fair View, Ulverston	1855
	Kennedy, Donald, Monteagle, Tain	1838
	Kennedy, Captain Hew Fergusone, of Finnart	1832
	Kennedy, James, Lamhorn Park, Tamworth,	1850
	Kennedy, John, of Kirkland	1839
	Kennedy, John, of Underwood, W.S.	1836
	Kennedy, John Lawson, of Knocknalling	1846
	Kennedy, Primrose William, of Drummellan	1842
1600	Kennedy, T., Nursery and Seedsman, Dumfries	1845
	Kennedy, William, Kilkenzie, Maybole	1842
	Ker, Robert, of Auchinraith	1854
	Kerr, Christopher, Dundee	1843
	Kerr, James, of Middlebank, Dunfermline	1838
	Kerr, John, Land Surveyor, Dunse	1853
	Kerr, Robert, Merchant, Leith	1854
	Kerr, Robert, of Lagary, Helensburgh	1857
	Kerr, William Williamson	1845
	Kerr, William, Wester Causewayend, Mid Calder	1854
1610	Kerr, William Scott, of Chatto	1833
	Kidston, Archibald G., Glasgow	1844
	Kidston, John P., Newton House, Cambuslang	1850
	Kilgour, Robert, jun.	1826
	King, Jas. Foster, Wester Longhaugh, Bishopton	1850
	King, William, Manufacturer, Glasgow	1839
	Kilpatrick, Robert, The Cairnies, Perth	1854
	Kinloch, Alexander John, of Park	1841
	Kinloch, George, of Kinloch	1825
	Kinloch, Colonel John, of Kilrie	1829
1620	Kinnear, Charles, of Kinloch	1824
	Kirk, John, W.S., Edinburgh	1848
	Kirkaldy, George D. H., of Hearensbrook, Ireland	1844
	Kirkcaldy, James, Balgillo, Broughty Ferry	1839
	Kirkpatrick, Alex., Drumatorran, Strontian	1857
	Kirkwood, Hugh, Killermont, Maryhill, Glasgow	1854
	Kirkwood, James, Implement Maker, Tranent	1854
	Kirkwood, John, Implement Maker, Tranent	1854

Admitted

Kirkwood, Robert, High Longmuir, Kilmaurs 1852
Kyle, Colonel Alexander, of Binghill 1835

1630 LEINSTER, His Grace Augustus, Duke of, Hon. Member 1841
LANSDOWNE, The Most Noble Henry, Marquis of, K.G., Honorary Member 1837
LOTHIAN, The Most Noble William Schomberg Robert, Marquis of 1854
†LEVEN and MELVILLE, The Right Hon. David, Earl of 1820
†LOVAT, The Right Hon. Thomas Alex., Lord 1820
LOVAT, The Hon. Simon Fraser, Master of 1853
LAUDER, Sir John Dick, of Fountainhall, Bart. 1848
LAMB, Sir Charles, of Beauport, Bart. 1836
LEITH, General Sir Alexander, of Freefield, K.C.B. 1811
LINDSAY, Lieut.-Colonel Sir Martin 1816
1640 Laing, Rev. Francis, of Carselogie 1824
Laing, John, of Hayfield, Newburgh, Fife 1856
Laing, Robert, Addinstone, Lauder 1850
Laing, Thomas, Yorkston, Fushié Bridge 1855
Laird, David, of Strathmartine 1833
Lamond, Robert, Writer, Glasgow 1838
Lamont, Alexander, of Knockdow 1819
Lamont, Archibald James, of Lamont 1840
Lamont, James, younger of Knockdow 1850
L'Amy, John R., of Dunkenny 1854
1650 Landale, Andrew, Easthall, Cupar-Fife 1855
Landale, Thomas, Colzie, Auchtermuchty 1855
Lang, Hugh M., of Blackdales, Largs 1849
Lang, William, of Groatholm, Kilwinning 1854
Langlands, James C., Bewick, Alnwick 1854
Latham, Patrick R., Aberchalder, Fort Augustus 1857
Laurie, John, of Maxwellton 1840
Laurie, Thomas, Terreglestown, Dumfries 1848
Laurie, William Kennedy, of Woodhall 1848
Law, Robert, Engineer, Shettleston, Glasgow 1838
1660 Lawrie, William, Ferneyflat, Slateford 1850
Lawson, Alexander, of Burnturk 1853
Lawson, Alexander, Merchant, Dundee 1843
Lawson, Alexander, Old Mills, Elgin 1854
Lawson, Charles, of Borthwick Hall, Seedsman, and Conservator of the Museum of the Society 1830

		Admitted
	Lawson, Charles, junior, Edinburgh	1846
	Lawson, Thomas, Calanach, Innellan	1854
	Lawson, William, Lessendrum, Huntly	1853
	Leadbetter, John, Merchant, Glasgow	1838
1670	Learmonth, John, of Dean	1814
	Learmonth, Thomas	1824
	Lees, John, Marvingston, Haddington	1855
	Leigh, Rev. Peter, Golborne Park, Lancashire	1823
	Leighton, James, Baldarroch, Banchory	1857
	Leith, Alexander, yr. of Freefield	1841
	Lennox, John L. Kincaid, of Woodhead	1824
	Leslie, George Abercrombie Young, of Kininvie	1840
	Leny, James Macalpine, of Dalswinton	1824
	Leslie, James, Thorn, Blairgowrie	1857
1680	Leslie, Robert, of Rothie	1845
	Leslie, William, of Drumrossie	1848
	Leslie, William, of Warthill	1826
	Liddell, James, Auchtertool House, Kirkcaldy	1843
	Lindsay, Alexander K., of Balmungo	1841
	Lindsay, Donald, Accountant, Edinburgh	1843
	Lindsay, John Mackenzie, Corn-Merchant, Dundee	1826
	Lindsay, John Mackenzie, W.S.	1846
	Lindsay, William, Solicitor, Leith	1854
	Lindsay, William, Stanhope, Stobo, Peebles	1855
1690	Lithgow, William, Stanmore House, Lanark	1857
	Lizars, William Home, Edinburgh	1835
	Loch, George, 12 Albemarle Street, London	1853
	Lockie, Andrew, West Morriston, Earlston	1855
	Lockhart, Alexander Macdonald, London	1835
	Lockhart, Allan Elliot, of Borthwickbrae, M.P.	1832
	Lockhart, James Sinclair, of Castlehill	1846
	Lockhart, John, Dunmore Park, Falkirk	1849
	Lockhart, Robert, Glasgow	1850
	Logan, Alexander, London	1831
1700	Logan, Alex. S., Advocate, Sheriff of Forfarshire	1848
	Logan, David, Fernycastle, Berwickshire	1854
	Logan, Edmond, W.S.	1855
	Logan, Thomas, Woodend, Dunse	1854
	Longmore, Andrew, Rettie, Banff	1852
	Longmore, John Alexander, W.S.	1837
	Lorimer, George, George Street, Edinburgh	1857
	Lorimer, James, of Kellyfield, Perth	1826

Admitted

Lorimer, Thomas Webster, Belkie, Perthshire 1843
Louson, David, Town-Clerk of Arbroath 1813
1710 Lovie, Alexander, Nether Boyndlie, Fraserburgh 1857
Low, David, of Laws 1825
Low, James, Berrywell, Dunse 1843
Low, James, Yonderton, Ellon 1854
Low, Colonel John, C.B. 1844
Low, Lieut.-Colonel Robert 1841
Lowndes, James, of Arthurlee 1850
* Lumsdaine, Rev. Edwin Sandys, of Blanerne 1837
Lumsden, George, Leslie Lodge, Keith Hall 1850
Lumsden, Hugh, of Pitcaple, Sheriff of Sutherland 1825
1720 Lumsden, James, Braco, Keith 1840
Lumsden, James, Glasgow 1844
Lumsden, John, Learmonth, Coldstream 1854
Lumsden, Colonel Thomas, of Belhelvie 1851
Lumsden, William James, of Balmedie 1841
Lyall, Charles, Kincraig, Brechin 1850
Lyall, David, of Gallery, Montrose 1854
Lyall, Robert, Carcary, Brechin 1850
Lyall, Robert, Old Montrose 1826
Lyall, Robert, Merchant, Glasgow 1843
1730 Lyell, Thomas, R.N., Kinnordy, Kirriemuir 1836
Lyon, George, of Glenogil 1809
Lyon, John Stewart, of Kirkmichael 1837

*MONTROSE, His Grace James, Duke of, K.T. 1821
MARCH, The Right Hon. Charles, Earl of, M.P. 1840
†MORTON, The Right Hon. George Sholto, Earl of 1828
†MANSFIELD, The Right Hon. David, Earl of, K.T. 1833
MANSFIELD, The Right Hon. the Dowager Countess of 1840
†MINTO, The Right Hon. Gilbert, Earl of, G.C.B. 1808
MELVILLE, Major-General The Right Hon. Henry Dundas, Viscount, K.C.B. 1856
1740 MACDONALD, The Right Hon. Godfrey William Wentworth, Lord 1833
MACKENZIE, The Right Hon. Holt 1833
MACAULAY, The Right Hon. T. B. 1839
M'NEILL, The Right Hon. Duncan, of Colonsay, Lord Justice-General 1833
MACKENZIE, The Hon. Lord 1851
MAITLAND, Admiral The Hon. Sir Anthony K.C.B. 1831

Admitted
MAULE, The Hon. William Maule, of Maulesden 1846
MACDONALD, The Hon. Archibald 1796
MURRAY, The Hon. Major David 1840
MORETON, The Hon. Augustus H. M., of Largie 1844
1750 MACKENZIE, The Hon. Mrs Stewart, of Seaforth 1816
MURRAY, The Hon. Lord 1823
MAXWELL, Sir W. A., of Calderwood, Bart. 1830
MENZIES, Sir Robert, of Menzies, Bart. 1841
MENZIES, The Hon. Lady, of Menzies 1839
MURRAY, Sir William Keith, of Ochtertyre, Bart. 1830
MAXWELL, Sir John, of Polloc, Bart. 1825
MAXWELL, Sir William, of Monreith, Bart. 1840
MAXWELL, Sir John Heron, of Springkell, Bart. 1839
MONCREIFFE, Sir Thomas, of Moncreiffe, Bart. 1843
1760 MACKENZIE, Sir Jas. John Randoll, of Scatwell, Bart. 1838
MACKENZIE, The Rt. Hon. Lady Anne, of Scatwell 1841
MACKENZIE, Sir William, of Coul, Bart. 1857
MILLER, Sir William, of Glenlee, Bart. 1837
MONTGOMERY, Sir Graham Graham, of Stanhope, Bart, M.P. 1843
MAXWELL, Sir David, of Cardoness, Bart. 1810
MAITLAND, Sir Alexander Charles Gibson, of Cliftonhall, Bart. 1847
MACKENZIE, Sir Evan, of Kilcoy, Bart. 1846
MACKENZIE, Sir Kenneth Smith, of Gairloch, Bart. 1854
MANSEL, Sir John, Bart. 1840
1770 MARJORIBANKS, Sir John, of Lees, Bart. 1854
MACTAGGART, Sir John, of Ardwell, Bart, M.P. 1839
MATHESON, Sir James, of Lews, Bart., M.P. 1843
M'NEILL, Sir John, G.C.B., Edinburgh 1846
MACDONELL, Lieut.-General Sir James, G.C.B. 1803
MACDONALD, Lieut.-General Sir John, of Dalchosnie, K.C.B. 1819
Macadam, John, of Blairover 1824
Macalister, Alexander, of Loup and Torrisdale 1840
Macalister, Major James, of Springbank 1807
1780 Macalister, Keith, of Glenbarr 1842
M'Alister, Robert, Mid Ascog, Rothesay 1855
Macallan, James, W.S. 1823
Macarthur, Major Alexander 1840
Macarthur, Duncan, Penningfair, Oban 1842
Macarthur, Dr Peter, Australia 1819

		Admitted
	Macaskill, Donald, of Rhudunan	1840
	Macaskill, Hugh	1830
	M'Auslin, J., Kilbridbeg, Cairndow	1853
	M'Andrew, D. M., Merchant, Leith	1854
1790	Macbean, Duncan, of Tomatin, Merchant, Glasgow	1828
	Macbean, Æneas, W.S.	1812
	Macbean, Lieut.-Colonel James	1806
	M'Bey, Peter, Land Surveyor, Elgin	1854
	M'Bryde, John, Balkerr, Stranraer	1851
	M'Call, Henry, younger of Daldowie	1846
	M'Call, James, of Daldowie	1844
	M'Call, Samuel, of Caitloch, Minniehive	1847
	M'Call, Thomas, Merchant, Glasgow	1838
	M'Callum, George Kellie, of Braco	1842
1800	M'Callum, John, Plewlands, Edinburgh	1843
	M'Caw, Alexander, Ardlochan, Maybole	1851
	M'Clean, Alexander H., Auchneel, Stranraer	1851
	MacClelland, George, W.S.	1838
	M'Coll, Donald, Appin House	1843
	M'Combie, James Boyn, of Gillybrands, Aberdeen	1840
	M'Combie, William, of Easter Skene	1840
	M'Combie, William, Tillyfour, Aberdeen	1847
	MacConnel, John, Penrith	1842
	M'Conochie, John, Mains of Penninghame, Newton-Stewart	1851
1810	M'Cowan, Robert, Secretary Glasgow Agricultural Society	1856
	M'Craken, John, Drum, Dumfries	1850
	M'Culloch, David, Auchness, Stranraer	1852
	M'Culloch, Walter, of Kirkclaugh, Gatehouse	1849
	Macdonald, Alexander, of Lochshiel	1824
	Macdonald, Major-General Alexander	1810
	Macdonald, Dr Alexander, Prince Edward's Island	1838
	Macdonald, Alexander, Inverness	1841
	Macdonald, Alexander, Broadford, Skye	1840
	Macdonald, Alexander, Balranald, Lochmaddy	1854
1820	Macdonald, Alexander S., Mudale, Lairg	1855
	Macdonald, Alister M'Ian, younger of Dalchosnie	1841
	Macdonald, Archibald Burns, of Glencoe	1855
	Macdonald, Captain Angus, of Milltown	1798
	Macdonald, Angus, of Glenaladale	1827
	Macdonald, Archibald, Islay	1838
	Macdonald, David, Lassintulloch, Kinloch Rannoch	1854
	Macdonald, Major Donald, of Ardmore	1822

Admitted

Macdonald, Donald, Bridge End, Dingwall 1850
Macdonald, Captain Donald, of Isauld 1817
1830 Macdonald, Harry, Banker, Portree 1857
Macdonald, Hugh P., Gourock, Portree 1830
Macdonald, James Thomas, of Balranald 1832
Macdonald, John, Procurator-Fiscal, Dunfermline 1836
Macdonald, John, of Monachyle, Lochearnhead 1857
Macdonald, John Robertson, Rodil, Harris 1841
Macdonald, Ranald, of Bornish 1806
Macdonald, Reginald George, of Clanranald 1807
Macdonald, Lieut.-Colonel R., of Inchkenneth, C.B. 1814
Macdonald, Roderick C., of Castle Teirim 1839
1840 Macdonald, Lieut.-Colonel William, of Powderhall 1813
Macdonald, Professor William, M.D., St Andrews 1818
Macdonald, William, Glasgow 1844
Macdonald, William Bell, of Rammerscales 1841
Macdonald, Wm. Macdonald, of St Martins 1844
Macdonell, Æneas Ronald, of Morar, Airsaig 1846
Macdouall, Colonel James, of Logan 1838
Macdougall, Alexander, Granton Farm, Edinburgh 1847
Macdougall, Allan, W.S. 1829
Macdougall, Colin, of Lunga 1808
1850 Macdougall, Captain James Patrick 1838
Macdougall, Major Patrick, of Soroba 1800
M'Dougall, Dugald, of Gallanach 1814
Macdougall, John of Macdougall, Captain R.N. 1821
Macdougall, John, Kerrytonlia, Rothesay 1853
M'Dougall, Patrick, younger of Gallanach, W.S. 1849
M'Dougal, Thomas, Eskmills, Penicuik 1856
M'Dowall, Colonel Day Hort, of Garthland 1846
Macdowall, Henry, Carruth, Renfrewshire 1845
Macduff, Alexander, of Bonhard 1843
1860 Macduff, Capt. Alexander, Blair-Athol 1839
Maceachern, Captain Colin, of Oatfield 1825
M'Ewan, Alexander, of Sunderland 1846
Macewan, James, of Tar of Ruskie 1834
M'Ewan, John, Merchant, Glasgow 1850
M'Ewan, John, Merchant, Inverness 1839
M'Ewan, Peter, Hill of Drip, Stirling 1851
Macfarlan, John Fletcher, Surgeon, Edinburgh 1823
Macfarlan, William, of Bencloich 1832
Macfarlane, Alexander, of Thornhill 1825
1870 Macfarlane, John, of Muckroy 1821

		Admitted
	M'Farlane, John, Faslane, Helensburgh	1851
	Macfarlane, Robert, Sheriff of Renfrewshire	1854
	Macfarlane, Thomas, Clachan, Cairndow	1826
	M'Gill, James, Torrorie, Kirkbean	1850
	M'Gill, John, Barsalloch, Wigtown	1850
	Macgillivray, William, Dunnygask, Dunfermline	1847
	Macgregor, Alexander, London	1837
	Macgregor, Alexander, Kinchurdy, Carrbridge	1855
1880	Macgregor, Donald Robert, Merchant, Leith	1857
	Macgregor, James, Fort-William	1833
	Macgregor, John, of Glengyle	1832
	Macgregor, Lieut.-General Murray	1801
	M'Ilraith, James, of Auchenflower	1835
	Macinroy, James Patrick, of Lude	1831
	Macinroy, Major William, of The Burn	1827
	Macintosh, Major-General, of Campsie	1852
	Macintyre, John, Cleugh Farm, Oban	1844
	M'Intyre, Archibald, Dunalunt, Rothesay	1855
1890	M'Iver, Evander, Scourie	1850
	Macivor, John, New South Wales	1827
	Mack, James, Upper-Keith, Blackshiels	1851
	Mack, William, of Berrybank, Reston	1854
	Mackay, Charles, Jeweller, Edinburgh	1839
	Mackay, Donald, Lythmore, Thurso	1852
	Mackay, George, of Bighouse	1846
	Mackay, Hugh, Mains of Burgie, Forres	1854
	Mackay, James, Edinburgh, Silversmith to the Society	1804
	Mackay, John, Banker, Inverness	1837
1900	Mackay, John, Soccoth, Dalmally	1857
	Mackay, John Alexander, of Blackcastle	1857
	Mackay, Thomas, Shiness, Lairg	1856
	Mackay, Thomas George, W.S.	1837
	M'Kechnie, Neil, Inverary	1855
	Mackellar, Duncan, Edinburgh	1839
	Mackenzie, Alex., Allanfiarn, Culloden, Inverness	1853
	Mackenzie, Alexander, of Muirton	1846
	Mackenzie, Captain Boyce, Creech, Bonar	1855
	Mackenzie, Daniel, jun., Merchant, Glasgow	1844
1910	Mackenzie, Donald, Advocate	1848
	Mackenzie, Donald, Balnabeen, Dingwall	1855
	Mackenzie, George, Dingwall	1830
	Mackenzie, James, W.S.	1855

Admitted
Mackenzie, John, Inchvannie, Dingwall 1850
Mackenzie, John, Barnhill, Dumfries 1850
Mackenzie, John, Kinnettas, Dingwall 1853
Mackenzie, John, of Glack 1835
Mackenzie, John, Manager, Scottish Widows' Fund, 1848
Mackenzie, John Munro, Glasgow 1853
1920 Mackenzie, John Ord, of Dolphinton, W.S. 1848
Mackenzie, John Whitefoord, W.S. 1821
Mackenzie, Keith William Stewart, of Seaforth 1846
Mackenzie, Kenneth, Accountant, Edinburgh 1848
Mackenzie, Kenneth Francis, Edinburgh 1811
Mackenzie, Kenneth John, Advocate 1845
Mackenzie, Murdo, Mountgerald, Dingwall 1853
Mackenzie, Murdo, of Dundonnell 1799
Mackenzie, Robert Duncanson, of Caldarvan 1838
Mackenzie, Roderick, Glack, Aberdeen 1856
1930 Mackenzie, Lieut.-Colonel, 92d Highlanders 1845
Mackenzie, Thomas, of Ord, Beauly 1846
Mackenzie, Dr William, of Culbo, Edinburgh 1810
Mackenzie, Wm., Carron, Ballindalloch 1857
Mackenzie, Wm., yr. of Cornhill, Perth 1852
Mackenzie, William Forbes, of Portmore 1831
M'Kessack, John, Balnaferry, Forres 1857
Mackie, James, younger of Bargaly 1845
Mackie, John, of Bargaly, M.P. 1844
Mackie, John, Oldtown of Coynack, Mintlaw 1853
1940 Mackie, John Wyse, Princes Street, Edinburgh 1852
Mackinlay, David, Oswald Bank, Patrick 1844
Mackinlay, David, of Newlandburn 1848
Mackinlay, James, Glasgow 1854
Mackinlay, John, Whitehaven 1818
Mackinnon, Alexander Kenneth, Corry, Broadford 1827
Mackinnon, Neil, of Demerara 1829
Mackinnon, William Alexander, of Mackinnon, M.P. 1811
Mackintosh, Æneas, of Daviot 1839
Mackintosh, Æneas W., of Raigmore 1844
1950 Mackintosh, Alexander, of Mackintosh 1833
Mackintosh, Major-General Alexander, of Farr 1839
Mackintosh, Alexander, Greenside St., Edinburgh 1856
Mackintosh, Angus, of Holm 1844
Mackintosh, Eneas, of Balnespick 1846
Mackintosh, George, of Geddes 1832
Mackintosh, George Gordon, Balnespick 1846
Mackintosh, James, of La Mancha 1851

		Admitted
	Mackintosh, John, Auchnacloich, Nairn	1849
	Mackintosh, Robert T., Seedsman, Edinburgh	1854
1960	Mackintosh, William, Australia	1813
	M'Kirdy, John Gregory, of Birkwood	1850
	M'Knight, Robert, of Barlochan	1840
	Maclachlan, Alexander, Easter Longhaugh, Paisley	1850
	Maclachlan, Colin	1836
	Maclachlan, Eun	1836
	Maclachlan, George, W.S.	1843
	Maclachlan, Robert, of Maclachlan	1817
	Maclagan, Douglas, M.D., Edinburgh	1853
	Maclagan, Peter, Invercauld, Braemar	1847
1970	Maclagan, Peter, yr. of Pumpherston, Mid-Calder	1847
	Maclaine, Donald, of Lochbuy	1855
	Maclaine, Hugh, of Killundine	1847
	Maclanachan, James, Van Dieman's Land	1855
	Maclaren, Major Alex., Portobello	1844
	Maclaren, Charles, Edinburgh	1833
	Maclaren, Duncan, Cambuserricht	1834
	Maclaren, Duncan, Edinburgh	1853
	Maclaren, John, of Balcmenoch	1839
	Maclaren, William, Glasgow	1850
1980	Maclean, Alexander, of Ardgour	1856
	Maclean, Alexander, of Carsaig	1835
	Maclean, Col. Allan Thomas	1835
	Maclean, Archibald D., London	1837
	Maclean, Colin, of Laggan, Islay	1838
	Maclean, Donald, of Boreray	1822
	Maclean, George, Hynish, Tyree	1849
	Maclean, Hector Frederick, W.S.	1854
	Maclean, Hugh, late of Coll	1819
	Maclean, Hugh, Brighton	1827
1990	Maclean, James, Braidwood, Penicuik	1841
	Maclean, Dr Lachlan, Tobermory	1823
	Maclean, Neil, Land-Surveyor, Inverness	1837
	Maclean, Patrick, of Hawkhill, Fortrose	1845
	Maclean, Thomas, Grain Merchant, Edinburgh	1853
	Maclean, William, of Plantation, Glasgow	1838
	Macleay, Alexander D., Bilbster, Wick	1846
	Macleay, Kenneth, of Newmore	1839
	M'Lellan, W. H., of Marks, Kirkcudbright	1857
	Maclennan, John	1840
2000	Macleod, Alexander, Surgeon, Uist	1829
	Macleod, Alexander, of Canada	1811

		Admitted
	Macleod, Alexander Norman	1817
	Macleod, Donald, Claggan, Dunvegan	1841
	Macleod, Donald, Kingsburgh, Skye	1830
	Macleod, John N., Banker, Kirkcaldy	1849
	Macleod, Martin, of Drynoch	1831
	Macleod, Norman, of Dalvey	1839
	Macleod, Norman, of Macleod	1839
	Macleod, Mrs, senior, of Macleod	1816
2010	Macleod, Robert Bruce Æneas, of Cadboll	1854
	Macleod, Colonel William	1817
	M'Michan, Bernard, Whitehill of Parton, Kirkcudbright	1854
	Macmillan, Donald, of Lephenstrath	1825
	Macmillan, Captain Iver	1798
	Macmillan, James, of Lamloch	1834
	M'Minn, Francis, Edinburgh	1854
	M'Murrich, James, of Stuckgown	1852
	M'Murtrie, John, Secretary Ayrshire Agricultural Association, Ayr	1854
	Macnab, Archibald, of Macnab	1806
2020	Macnab, James Monro	1837
	M'Nab, Duncan	1855
	M'Nab, Thomas	1853
	Macnair, James, of Auchineck	1838
	Macnaghten, J. Steuart, of InverTrossach, Callander	1855
	Macnaughton, James, of Smithfield	1854
	M'Naughton, Alexander, Remony, Kenmore	1857
	Macneale, George, of Ugadale	1825
	Macneale, Hector, yr. of Ugadale	1848
	M'Neill, Archibald, W. S., Edinburgh	1846
2030	M'Neill, Macolm Macmillan, younger of Carskey	1839
	Macneill, Alexander, Advocate	1835
	Macneill, John, of Ardnacross	1847
	Macneill, Lieut.-General Roderick	1817
	Macnicol, Lieutenant Nicol, Dunans	1836
	M'Nicoll, John, Craig, Alyth	1831
	Maconochie, Robert Blair, W.S.	1852
	Macpherson, Alexander, M.D., Garbity	1841
	Macpherson, Allan, London	1822
	Macpherson, Major Duncan, Falls of Truim, Kingussie	1839
2040	Macpherson, Captain, Breakachy, Laggan	1854
	Macpherson, Ewan, of Cluny Macpherson	1827
	Macpherson, George, Gibston, Huntly	1850

Admitted

Macpherson, James, Biallid, Kingussie 1856
Macpherson, John, Blantyre, Glasgow 1856
Macpherson, John, Kenmore 1857
Macpherson, Captain Lachlan, Biallidmore, Kingussie 1839
Macpherson, William, of Blairgowrie 1822
Macqueen, Robert, of Braxfield 1842
Macqueen, Captain Simon, Corrybrough 1820
2050 Macrae, Alexander, Askernish, Caranish 1832
Macrae, Archibald, M.D., Bruiach, Beauly 1839
Macrae, Donald, Luskintyre, Harris 1850
Macrae, Rev. Finlay, North Uist 1841
Macredie, Patrick Boyle Mure, of Perceton 1830
Macritchie, Charles Elder, Edinburgh 1831
Macritchie, John, Whitburgh, Ford 1846
Macritchie, Thomas Elder, of Craigton, W.S. 1831
Mactaggart, Captain J. O., of Seafield 1835
MacTier, Alexander Walker, of Durris 1848
2060 Macturk, Robert, of Hastingshall 1826
Macvicar, John, of Ardarroch 1842
Macvicar, Rev. J. G., D.D., Moffat 1828
M'Watt, John Purves, Secretary East Lothian Agricultural Society, Haddington 1854
Macwilliam, Alexander, Bucharn, Huntly 1850
Macwilliam, George, Sheriffston, Elgin 1841
M'William, James, Upper Kidston, Peebles 1855
M'William, Robert, Turtory, Huntly 1852
Madden, Henry R., M.D., Brighton 1839
Main, Alexander, Dalhousie, Mid-Lothian 1849
2070 Main, Alexander James, Whitehill, Lasswade 1847
Main, James A. R., Glasgow 1855
Maitland, George F., of Hermand 1852
Maitland, James, Scotstown, Inch, Aberdeen 1856
Maitland, Stuart Cairns, of Dundrennan 1852
Makellar, Rev. Angus, D.D., Edinburgh 1818
Makgill, George, of Kembach 1841
Makins, Edward, Auchincrow Mains, Ayton 1841
Malcolm, Neill, of Poltalloch 1830
Malcolm, W. E., of Burnfoot 1840
2080 Mann, John, Glasgow 1847
Mansfield, Thomas, Accountant, Edinburgh 1827
Manson, David D., Spynie, Elgin 1853
Manson, James, Oakhill, Old Meldrum 1855
Marjoribanks, Dudley Coutts, of Guisachan 1856

		Admitted
	Marjoribanks, John, Castle Mains, Dirleton	1856
	Marjoribanks, William, Merchant, Leith	1854
	Marr, William Smith, Upper Mill of Tillyhilt, Tarves	1855
	Marshall, Claud, Greenock,	1819
	Marshall, James, Jeweller, Edinburgh	1833
2090	Marshall, John, younger of Curriehill	1854
	Marshall, John, Klibreck, Lairg	1847
	Marshall, Robert, Gateside, Kirkliston	1850
	Marshall, Walter, Jeweller, Edinburgh	1839
	Marshall, William, Merchant, Leith	1854
	Marshall, Captain William, Rothesay	1845
	Marshall, William, Goldsmith, Edinburgh	1843
	Martin, George, Civil Engineer, Glasgow	1839
	Martin, James Watson, Old Saughton, Slateford	1850
	Martin, Dr Nicol, of Glendale, Dunvegan	1854
2100	Martin, William, Largie, Lochgilphead	1844
	Martin, William, Secretary, Renfrewshire Agricultural Society, Paisley	1846
	Mason, Thomas, Palinsburn Cottage, Coldstream	1854
	Mather, Arthur, Nether Place, Newton Mearns	1850
	Matheson, Alexander, of Ardross, M.P.	1846
	Matheson, Colonel Thomas	1847
	Mathews, Niven, Whitehills, Garliestown	1853
	Mathieson, George, of Clifton Lodge, Edinburgh	1854
	Maxtone, James, of Cultoquhey	1848
	Maxtone, John, Wine-Merchant, Leith	1835
2110	Maxwell, Francis, of Breoch	1841
	Maxwell, Francis	1844
	Maxwell, Henry Constable, of Milnehead	1838
	Maxwell, John Hall, of Dargavel, C.B., Secretary of the Society	1838
	Maxwell, Marmaduke C., of Terregles	1830
	Maxwell, Wellwood, of The Grove	1838
	Maxwell, Wellwood, of Munches	1839
	Maxwell, Wellwood, yr. of Glenlee	1855
	Maxwell, William, younger of Cardoness	1841
	Maxwell, William, of Carruchan	1837
2120	Maxwell, Wm. Constable, of Nithsdale	1830
	May, George, Civil Engineer, Inverness	1839
	Mayne, Robert, Melville Street, Edinburgh	1838
	Meall, James, Buttergask, Coupar-Angus	1852
	Meason, Magnus Gilbert Laing, of Ballinshoe	1836
	Mechi, John Joseph, of Tiptree Hall, Essex	1845
	Meek, George, of Campfield	1814

		Admitted
	Megget, Thomas, W.S.	1811
	Meiklam, John, of Dhuloch, Inverkeithing	1857
	Meikle, David, Clunie Mains, Fifeshire	1854
2130	Meiklejohn, Rev. Robert, Strathdon	1840
	Mein, Robert, Factor to the Duke of Bedford	1838
	Meldrum, Alexander, of Easter Kincaple	1841
	Melrose, Jonathan, Newbigging, Coldstream	1854
	Melville, James Moncrieff, of Hanley, W.S.	1848
	Melville, John Whyte, of Mount Melville	1819
	Melvin, James, Bonnington, Ratho	1849
	Menzies, Major Archibald, Edinburgh	1817
	Menzies, Fletcher Norton, Tirinie, Aberfeldy	1841
	Menzies, Graham, Edinburgh	1853
2140	Menzies, James, Auch, Tyndrum	1857
	Menzies, James Alex. Robertson, Surgeon, Annat	1849
	Menzies, John S., of Chesthill	1821
	Menzies, Ranald, of Culdares	1842
	Mercer, Græme, of Gorthy	1850
	Mercer, Major, Edinburgh	1853
	Merricks, James, Gunpowder Manufacturer, Roslin	1841
	Merry, James, Glasgow	1838
	Middleton, Charles Stuart, Merchant, Liverpool	1840
	Mill, James, Surgeon, Thurse	1839
2150	Millar, Andrew, Niddry Mains, Kirkliston	1853
	Millar, C. H., Merchant, Montrose	1853
	Millar, James Lawson, Waulkmill, Dunfermline	1852
	Millar, John, South St Andrew Street, Edinburgh	1848
	Millar, Thomas, Irish Estate Agent, Edinburgh	1854
	Millar, Thomas, West Briggs, Kirkliston	1853
	Millar, Thomas, Pilmuir, Largo	1854
	Miller, Captain Alexander Penrose	1843
	Miller, George, of Frankfield	1814
	Miller, Hew, Ochtertyre, Crieff	1853
2160	Miller, John, of Leithen	1847
	Miller, O. G., Merchant, Dundee	1843
	Miller, Richard, Merchant, Leith	1857
	Miller, William, Oldhamstocks, Cockburnspath	1854
	Milligan, James, Hayfield, Thornhill	1855
	Milne, Alexander, of Gartferry	1844
	Milne, Alexander, Mains of Elsemont, Ellon	1851
	Milne, Alexander, Mill of Allathan, Udny	1855
	Milne, George, of Kinaldie	1851
	Milne, George, Haddo, Methlic	1851
2170	Milne, James, Kilduthie, Banchory	1857

		Admitted
	Milne, James, Nethertown, Rosehearty	1856
	Milne, James, Pitsligo Castle, Rosehearty	1856
	Milne, Nicol, of Faldonside	1841
	Milne, William, (Marr and Milne), Aberdeen	1854
	Milne, William, Mains of Waterton, Ellon	1851
	Mitchell, Alexander, of Sauchrie	1851
	Mitchell, Andrew, Alloa	1848
	Mitchell, Duncan, Blairvoucky, Luss	1857
	Mitchell, George, Auchnagathle, Whitehouse, Aberdeenshire	1852
2180	Mitchell, Houston, of Polmood	1848
	Mitchell, James P., Traprain, Prestonkirk	1855
	Mitchell, James, of Affleck	1854
	Mitchell, James, Little Knock, Castle Douglas	1851
	Mitchell, John, Ballemenach, Campbeltown	1850
	Mitchell, John, Inverscaddle, Ardgour	1843
	Mitchell, John M., Merchant, Leith	1832
	Mitchell, Joseph, Civil Engineer, Inverness	1836
	Mitchell, Robert, Cadham, Markinch	1852
	Mitchell, Samuel, Strath, Campbeltown	1850
2190	Mitchell, Thomas, Kirkhope, Selkirk	1853
	Mitchell, William Gillespie, of Carwood	1849
	Mitchelson, Arch. Hepburne, Old Faskally	1832
	Moffat, James, Garwald, Langholm	1850
	Moffat, John, Craick, Hawick	1850
	Moffat, Wm., Craigbeck, Moffat	1851
	Moir, Benjamin, Merchant, Aberdeen	1840
	Moir, John Macarthur, of Hillfoot and Milton	1834
	Moir, Robert, Tarty, Ellon	1851
	Moir, Robert Graham, of Leckie	1850
2200	Moncrieff, Alexander, W.S., Perth	1842
	Moncrieff, Alexander, of Barnhill	1852
	Moncrieff, George, Writer, Perth	1852
	Moncreiff, James, M.P., Lord Advocate for Scotland	1848
	Moncrieff, Robert Scott, of Fossoway	1831
	Monro, Dr Alexander, of Craiglockhart	1807
	Monro, Alexander, younger of Craiglockhart	1835
	Monro, Alexander Binning, of Auchinbowie	1833
	Monro, David, of Allan, Tain	1851
	Monteath, Brydon, Nether Liberton, Edinburgh	1846
2210	Monteath, James, of Monkridden Mains	1845
	Monteath, John, younger of Monkridden Mains	1845
	Monteith, Alexander Earle, Sheriff of Fifeshire	1848

		Admitted
	Monteith, Robert, of Carstairs	1837
	Montgomerie, Rear-Admiral Alexander	1834
	Montgomery, John H., of Newton	1846
	Moore, James Carrick, of Corsewall	1829
	Moore, John Carrick, younger of Corsewall	1839
	More, George, of Kirkland, Haddington	1855
	More, John Shank, Advocate, Professor of Scots Law, University of Edinburgh	1816
2220	Morgan, James, S.S.C.	1841
	Morison, Alexander, of Bognie and Mountblairy	1840
	Morison, Andrew, Inchmichael, Errol	1852
	Morison, James G., Touch House, Stirling	1850
	Morrieson, Robert, Edinburgh	1833
	Morris, William Pollok, of Craig	1833
	Morrison, Alex., of Balinakeil, Writer, Glasgow	1838
	Morrison, Charles, younger of Islay	1855
	Morrison, James, younger of Balinakeil, Glasgow	1850
	Morrison, James, Mains of Montcoffer, Banff	1856
2230	Morton, Hugh, Engineer, Edinburgh	1835
	Morton, John Lockhart, Land Agent, London	1852
	Mosman, Captain Hugh, of Auchtyfardle	1850
	Moubray, John Marshall, W.S.	1843
	Mudie, John, of Pitmuies, Advocate	1840
	Muir, George W., Caberston, Innerleithen	1852
	Muir, James, Barone Park, Rothesay	1849
	Muir, John, of Gartferry	1843
	Muirhead, Claud, Edinburgh	1820
	Munro, Donald, Stornoway	1857
2240	Munro, George Gun, of Poyntzfield, Fortrose	1856
	Munro, Hugh Andrew Johnston, of Novar	1832
	Munro, John, Farnington, Kelso	1853
	Munro, Thomas M. Scott, of Benrig	1843
	Murdoch, James, Carntyne, Shettleston	1854
	Murdoch, John Burn, of Gartincaber	1820
	Murdoch, John Burn, junior, Advocate	1853
	Murdoch, Peter, Newton	1839
	Murdoch, Robert, Cranhill, Shettleston	1854
	Murdoch, William, Huntly	1856
2250	Mure, David, Sheriff of Perthshire	1847
	Mure, James O. Lockhart, of Livingstone	1828
	Mure, Colonel William, of Caldwell	1840
	Mure, William, Grange, Kirkcudbright	1841
	Murray, Andrew, of Conland	1846
	Murray, Andrew G., Alma Cottage, Banchory	1857

		Admitted
	*Murray, Anthony, of Dollerie, W.S.	1828
	Murray, George, Mount Pleasant, Berwick	1854
	Murray, Jack W., Captain R.N.	1843
	Murray, James, Monkland Iron Works	1828
2260	Murray, James, of Craigend, Drochil Castle, Pe bles	1840
	Murray, James, East Barns, Dunbar	1850
	Murray, James, Auchterellon, Ellcn	1851
	Murray, John, of Polmaise	1840
	Murray, John, of Murryshall, Advocate	1842
	Murray, John Dalrymple, of Murraythwaite	1825
	Murray, John Nesbitt, of Philiphaugh	1846
	Murray, Joseph, of Ayton	1820
	Murray, Kenneth, Banker, Tain	1851
	Murray, Robert, Spittal, Penicuik	1850
2270	Murray, Captain Samuel Hood	1834
	Murray, Sutherland, Kirkton, Golspie	1851
	Murray, Thomas Graham, W.S.	1852
	Murray, Walter, Walston, Penicuik	1854
	Murray, William, Monkland House	1827
	Murray, William, Kilcoy, Dingwall	1856
	Murray, William Hugh, of Geanies, Advocate	1846
	Mustard, James, Leuchland, Brechin	1850
	Mutrie, David, Merchant, Glasgow	1804
	Mylne, Thomas, Niddrie Mains, Liberton	1850
2280	Mylne, William, Lochhill, Aberlady	1841
	NORTHESK, The Right Hon. William, Earl of	1843
	NAPIER, The Right Hon. Francis, Lord	1843
	NEAVES, The Hon. Lord	1846
	NAPIER, Sir Robert John Milliken, of Milliken, Bt.	1848
	NICHOLSON, Sir Arthur, of Nicholson, Bart.	1812
	Nairne, John Mellis, of Dunsinnan	1852
	Naismith, Alexander, Windlestrawlee, Edinburgh	1852
	Napier, George, Advocate, Sheriff of Peeblesshire	1840
	Napier, Robert, of Shandon	1844
2290	Nasmyth, Robert, Edinburgh	1839
	Neill, John, Merchant, Leith	1854
	Neilson, James Beaumont, of Queenshill	1851
	Nelson, Joseph, Killiminger, Dumfries	1857
	Newall, James, Banker, Newton-Stewart	1845
	Newall, John	1845
	Newton, James, of Castlandhill, W.S.	1846
	Newton, James Ewan, of Whitecroft, Lockerbie	1838

		Admitted
	Newton, Robert Pillans, Kerse, Falkirk	1837
	Nicol, James Dyce, of Badentoy	1853
2300	Nicoll, Alexander	1844
	Nicolson, Major Allan Macdonald, of Ardmore	1819
	Nicolson, James Archibald Stewart, of Carnock	1853
	Nicolson, John Badenach, yr. of Glenbervie, Stonehaven	1857
	Nielson, Andrew, Bank of Scotland, Glasgow	1843
	Nimmo, James, Sight Hill, Corstorphine	1847
	Nimmo, Matthew, Foot of Green, Stirling	1852
	Nisbet, John, Rumbleton, Greenlaw	1854
	Nisbet, Ralph P., Elwick, Belford	1855
	Nisbet, Thomas, Hanover Street, Edinburgh	1854
2310	Nisbett, John More, of Cairnhill	1847
	Nivison, Thomas, Burn, Thornhill	1852
	Noble, John, London	1838
	Noble, William, London	1838
	Ogilvy, The Hon. William, of Loyal	1823
	Ogilvy, The Hon. Donald, of Clova	1824
	Ogilvy, Sir John, of Inverquharity, Bart.	1824
	Orde, Sir John Poullet, of Kilmory, Bart.	1830
	Ogilvie, Archibald, West Newington, Edinburgh	1854
	Ogilvie, Captain William, R.N.	1820
2320	Ogilvie, William, of Chesters	1809
	Ogilvie, William, Broadhaugh, Hawick	1853
	Ogilvy, Charles, Broomknow, Brechin	1850
	Ogilvy, John, of Inshewan	1836
	Ogilvy, Peter Wedderburn, of Ruthven	1826
	Ogilvy, Thomas, younger of Ruthven	1844
	Ogilvy, Thomas, of Corrimony	1838
	Ogston, Alexander, of Ardo	1840
	Oliphant, Laurence, of Condie	1828
	Oliphant, Robert, of Rossie	1840
2330	Oliver, James, Burnfoot, Hawick	1850
	Oliver, James, Secretary West Teviotdale Agricultural Society, Hawick	1852
	Oliver, Robert, Blakelaw, Kelso	1853
	Oliver, Thomas, West Fortune, Haddington	1855
	Oliver, Thomas, Hermiston	1856
	Ord, John, of Muirhouselaw	1841
	Ormiston, William Thomas, of Glenburnhall	1848
	Orr, Andrew, of Glenfield	1844
	Oswald, Alexander, of Auchencruive	1845

		Admitted
	Oswald, J. Townshend, of Dunikier	1848
2340	Ovens, Thomas, Merchant, Galashiels	1851
	†POLWARTH, The Right Hon. Henry Francis H., Lord	1829
	PANMURE, The Right Hon. Fox, Lord, K.T.,	1831
	POLLOK, Sir Hew Crawford, of Pollok, Bart.	1846
	PRINGLE, Sir John, of Newhall, Bart.	1810
	PARISH, Sir Woodbine	1819
	Pagan, Allan Cuningham, Holestane, Thornhill	1852
	Pagan, Samuel A., M.D., Edinburgh	1848
	Pagan, William, of Clayton, Cupar-Fife	1845
	Park, Archibald, Merchant, Edinburgh	1854
2350	Park, David, Tynefield, Dunbar	1854
	Park, John, Wooden, Kelso	1853
	Park, Thomas, Stoneyhill, Musselburgh	1854
	Park, William, of Blegbie, Melrose	1849
	Parkes, Samuel, London	1817
	Paterson, Alexander, Wine-Merchant, Leith	1840
	Paterson, Alexander, Mains of Mulben, Keith	1853
	Paterson, Archibald, Meadowfield, Corstorphine	1848
	Paterson, D. A., Merchant, Leith	1854
	Paterson, George, of Castle Huntly	1841
2360	Paterson, James, Whitehouse, Lamlash	1853
	Paterson, John, West Hopes, Dalkeith	1850
	Paterson, John, East Preston, Kirkbean	1850
	Paterson, John, junior, Kileonan, Campbeltown	1847
	Paterson, John, Macoriston, Doune	1852
	Paterson, John J. W., Terrona, Langholm	1854
	Paterson, Peter Hay, of Carpow	1849
	Paterson, Robert, of Birthwood	1848
	Paterson, Robert, of Broklehirst	1835
	Paterson, Walter, Merchant, Glasgow	1851
2370	Paterson, William, Twiglees, Lockerbie	1851
	Patison, John, W.S.	1806
	Paton, John, of Crailing	1833
	Paton, John, of Grandholm	1841
	Paton, Robert, Cloberhill, Dumbarton	1854
	Patrick, William, of Roughwood, W.S.	1805
	Patterson, William, of Cunnoquhie	1847
	Patterson, John, Westerton of Cowie, Stirling	1850
	Patterson, Robert, Offers, Stirling	1851
	Patton, George, of the Cairnies, Advocate	1843
2380	Paul, Henry, Edinburgh	1830

		Admitted
	Paul, Rev. John, D.D., Edinburgh	1839
	Paul, William, Advocate, Aberdeen	1855
	Paul, William, Kilnflat, Forres	1855
	Pearson, Andrew A., of Springfield, Carluke	1854
	Peddie, William, of Blackruthven, Perth	1828
	Pender, Thomas	1839
	Pender, William, Condorat, Dumbarton	1852
	Penny, William, Advocate	1844
	Peter, Charles, Canterland, Marykirk	1854
2390	Peter, John, Croyard, Beauly	1854
	Peter, Robert, Banker, Aberfeldy	1849
	Philip, George, Boynds, Keith Hall	1856
	Philip, Robert	1844
	Philip, John, Polton Mains, Lasswad	1851
	Phillips, Charles, Cracrop, Brampton	1854
	Phillips, John, Laighpark, Milngavie	1854
	Philp, John, Edinburgh	1828
	Pillans, James, Edinburgh	1799
	Piper, Edward, Edinburgh	1833
2400	Pirie, James, Orchardton, Udny	1855
	Pirie, James, Ardconnon, Old Meldrum	1855
	Pitcairn, John, of Pitcullo, Cupar	1841
	Pittendrigh, John, Bodychell, Fraserburgh	1857
	Playfair, William Henry, Architect, Edinburgh	1824
	Plummer, Charles Scott, of Sunderlandhall	1842
	Plummer, George Hay, Melville, Dalkeith	1850
	Pollexfen, James R., of Cairston, W.S.	1841
	Pollok, Allan, of Faside	1844
	Pollok, Arthur, of Lochlibo	1815
2410	Pollok, John, Merchant, Glasgow	1838
	Polson, John, Moy, Dingwall	1853
	Ponton, George, Woolston, Linlithgow	1852
	Popham, Strachan Irvine, Ardchattan Priory, Bonaw	1843
	Porteous, Alexander, of Lauriston	1851
	Porteous, Robert, Milton, Lesmahagow	1850
	Porter, James, Monymusk, Aberdeen	1855
	Pott, George, of Todrig	1848
	Pott, Gideon, Rewcastle, Jedburgh	1854
	Powrie, James, of Reswalie	1849
2420	Poynter, John, 83 Jamaica Street, Glasgow	1856
	Prentice, George, Bankhead, Kinghorn	1855
	Primrose, James, Turniedykes, Ford	1855
	Pringle, Alexander, of Whytbank	1821

		Admitted
	Pringle, Rear-Admiral James, of Torwoodlee	1820
	Pringle, Robert K., of Broadmeadows	1852
	Proctor, William D., Glammis	1829
	Proudfoot, John, Inveresk, Musselburgh	1848
	Purdie, Thomas, Nelson Street, Edinburgh,	1856
	Purves, Charles, Crichton Mains, Ford	1855
2430	Purves, George, Little Pinkerton, Dunbar	1853
	Purves, James, Thurdistoft, Thurso	1839
	Purves, John, of Kinaldie	1844
	Purves, William, Burnfoot, Jedburgh	1851
	QUEENSBERRY, The Most Noble Arch. William, Marquis of	1850
	*RICHMOND and LENNOX, His Grace Charles, Duke of, K.G.	1836
	*ROXBURGHE, His Grace James Henry Robert, Duke of, K.T.	1837
	†ROSEBERY, The Right Hon. Arch. Jn., Earl of, K.T.	1806
	†ROSSLYN, The Right Honourable James Alexander, Earl of	1835
	ROTHES, The Right Hon. George Wm. Evelyn Leslie, Earl of	1857
2440	ROLLO, The Right Hon. John Rogerson, Lord	1857
	ROSSMORE, The Right Hon. Henry Robert, Lord	1850
	RICHARDSON, Sir John Stewart, of Pitfour, Bart.	1823
	RAMSAY, Sir James, of Bamff, Bart.	1823
	RIDDELL, Sir James Miles, of Ardnamurchan	1808
	RADCLIFFE, Sir Joseph, of Millsbridge, Bart.	1820
	RUSSELL, Gen. Sir J., of Ashiesteil, K.C.B.	1823
	RUSSELL, Sir William, of Charlton, Bart.	1853
	Raeburn, Henry, of Howden, Midcalder	1806
	Rainy, George, of Rasay	1846
2450	Rait, D. C., Goldsmith, Glasgow	1838
	Rait, James, of Anniston	1854
	Ralston, Alexander, Lagg, Dunure	1855
	Ralston, Robert William, younger of Glenelrig	1840
	Ramage, Alexander, Kinleith, Currie	1854
	Ramsay, Alexander, of Demerara	1806
	Ramsay, John, of Kildalton, Bowmore	1856
	Ramsay, Captain John, of Barra, Straloch, Aberd.	1856
	Ramsay, Robert Balfour Wardlaw, of Whitehill	1841
	Ramsay, Captain Thomas, Banchory Lodge	1828

		Admitted
2460	Ramsay, Captain, Paxton House, Berwick	1854
	Ramsay, Thomas, Derwent Haugh, Newcastle	1851
	Ramsay, Professor William, Glasgow	1844
	Ramsay, Lt.-Col. Wm. Burnett, of Banchory Lodge	1841
	Ranken, Bryce Macmurdo, Proc.-Fisc. of Orkney	1841
	Ranken, George, Australia	1839
	Ranken, Patrick, of Mavisbank	1844
	Ranken, Thomas, S.S.C.	1838
	Ranken, William, M.D., Glenlogan	1836
	Rannie, Robert Walker, Inchyra, Perth	1827
	Rashleigh, William, of Menabilly	1837
2470	Rate, John, Milton, West Salton	1852
	Rattray, James C., of Craighall	1854
	Rawdin, J., Chemist, Jedburgh	1856
	Ray, William, Sunbank, Elgin	1854
	Reed, Ellerington, Kilcalmkill, Golspie	1847
	Reed, Robert, Sidera, Golspie	1847
	Reid, Benjamin, Balcairn, Old Meldrum	1855
	Reid, Charles G. of Grangehill, W.S.	1844
	Reid, James, Muirton, Belhelvie	1852
	Reid, James, Ballencrieff, Drem	1855
2480	Reid, Patrick, Cattle-dealer, Bathgate	1854
	Reid, Peter, Waulk-Milton, Linlithgow	1855
	Reid, Walter, Drem, Haddington	1850
	Rennie, William, Banker, Maybole	1836
	Renton, Archibald Campbell, of Lamberton, Berwick	1857
	Renton, James, Accountant	1841
	Rhind, Josiah, Banker, Wick	1839
	Rhind, David, Architect, Edinburgh	1852
	Rhind, Macduff, Sheriff-Subs. of Wigtownshire	1843
	Richardson, Francis, Merchant, Edinburgh	1849
2490	Richardson, James, Merchant, Edinburgh	1833
	Richardson, James, of Ralston	1850
	Richardson, John, Writer, Haddington	1851
	Richardson, Robert, Merchant, Edinburgh	1837
	Richardson, Colonel Rob. Robertson of Tullybelton	1847
	Richardson, Thomas, younger of Ralston	1854
	Richardson, William, Banker, Lockerbie	1843
	Rickman, Thomas, Architect, Birmingham	1831
2500	Riddell, Campbell D., New South Wales	1816
	Riddell, John, Advocate	1817
	Riddell, Thomas Miles, younger of Ardnamurchan	1845
	Riddell, Lieut.-General Henry J.	1849
	Riddell, Thomas, Oxnam Nook, Jedburgh	1854

		Admitted
	Riddell, Wm., Hundalee, Jedburgh	1852
	Rigg, James Home, of Tarvit	1824
	Rintoul, Charles, East Craigie, Cramond	1852
	Ritchie, Archibald, Ireland	1853
	Ritchie, James, Princes Street, Edinburgh	1854
2510	Ritchie, Robert, Civil Engineer, Edinburgh	1833
	Ritchie, Thomas, Bowhouse, Alloa	1838
	Ritchie, William, Cattle Agent, Edinburgh	1853
	Ritchie, William, of Middleton	1848
	Ritchie, William, Plean Mill, Stirling	1852
	Robb, James, Gorgie, Slateford	1849
	Roberton, James, Ladyrig, Kelso	1841
	Robertson, Alexander, W.S.	1825
	Robertson, Alexander, Ardlaw, Rosehearty	1856
	Robertson, Alexander Inglis, of Aultnaskiach	1839
2520	Robertson, Andrew, Balmoral	1832
	Robertson, Arthur John, of Inches	1840
	Robertson, Charles, Buttergask, Perth	1836
	Robertson, David, of Ladykirk	1842
	Robertson, David, Aberdeen	1847
	Robertson, Donald, Inverleith Row, Edinburgh	1854
	Robertson, George, Edinburgh	1819
	Robertson, Captain George A.	1817
	Robertson, George Duncan, of Strowan	1839
	Robertson, Henry, of Borland	1832
2530	Robertson, James, Inveraray	1836
	Robertson, James, Hall of Caldwell, Beith	1852
	Robertson, James Stewart, of Edradynate	1811
	Robertson, James Stewart, yr. of Edradynate, W.S.	1851
	Robertson, Captain John, Edinburgh	1825
	Robertson, John, Banker, Huntly	1847
	Robertson, John, Bowhouse, Polmont	1855
	Robertson, John, of Gartloch, Glasgow	1856
	Robertson, John, Glenlyon House, Fortingal	1854
	Robertson, John, Edenmouth, Kelso	1854
2540	Robertson, Lawrence, Banker, Glasgow	1828
	Robertson, Robert, of Auchleeks	1828
	Robertson, Robert, younger of Auchleeks	1845
	Robertson, Stewart, of Derculich	1843
	Robertson, William, of Kinlochmoidart	1826
	Robertson, William, Burnside, Ballindalloch	1852
	Robertson, William, Erray, Tobermory	1856
	Robertson, William, Cuttlebrae, Fochabers	1857
	Robinow, Adolphus, Merchant, Leith	1851

Admitted

Robson, Charles, Lurdenlaw, Kelso 1841
2550 Robson, John, East Kielder, Northumberland 1853
Robson, William, Kilbreck, Lairg 1850
Rodger, David, Penkiln, Garlieston 1851
Rodger, Mathew, of Rossland, Bishopton 1854
Rodger, Robert, Merchant, Glasgow 1838
Rogers, George, Kilconquhur Mains, Colinsburgh 1842
Rogerson, George, Piersbyhall, Lockerbie 1851
Rogerson, William, of Gillesbie 1829
Rolland, Adam, of Gask 1837
Rollo, David, Currie 1852
2560 Rose, James, W.S. 1839
Rose, William, Fosterseat, Elgin 1854
Ross, Alexander, Ley, Banchory 1857
Ross, George, of Pitcalnie 1839
Ross, Lieut.-Col. George W. H., of Cromarty 1849
Ross, Colonel James Kerr, of Lawrence Park 1839
Ross, John Leith, of Arnage 1843
Ross, Richard Louthian, of Staffold 1804
Ross, Thomas, Bachilton, Perth 1856
Ross, William, of Greenside, Largo 1854
2570 Roughead, David, Seedsman, Haddington 1850
Rowand, Alexander, younger of Linthouse 1844
Rowand, Michael, of Linthouse, Glasgow 1838
Rowat, Thomas, Curriehill, Currie 1855
Roy, Alexander, Waterton, Inch, Aberdeen 1856
Roy, Frederick Lewis, of Nenthorn 1837
Roy, James jun., Nursery and Seedsman, Aberdeen 1840
Roy, John James, Avochie, Rothiemay 1825
Roy, Robert, W.S., Chester 1822
Royds, Robert Whyt, Kirkcaldy 1856
2580 Royle, Dr John Forbes, Honorary Member 1841
Russell, Alexander James, W.S. 1846
Russell, Andrew Walker, of Kenlygreen, Newburgh 1854
Russell, Francis Whitworth 1835
Russell, James, of Aden 1834
Russell, James, of Blackbraes 1834
Russell, James, Saughtonhall, Slateford 1848
Russell, James, Coalstoun Mains, Haddington 1851
Russell, James L., M.D., Thornhill, Secretary, Nithsdale Agricultural Society 1847
Russell, John, one of the Principal Clerks of Session 1806
2590 Russell, Robert, of Dalnair 1834
Russell, Robert, Kilwhiss, Ladybank 1851

Admitted

Rutherford, Walter, Crailing Tofts, Jedburgh 1851
Rutherfurd, Wm. Oliver, of Edgerston and Dinlabyre 1825
Ruxton, Andrew, Dorbshill, Ellon 1854
Ruxton, John, M.D., Hill of Fiddes, Hill of Menie 1851
Ruxton, William, Farnell, Brechin 1850
Ryburn, James, Drumlandle, Campbeltown 1850

*SUTHERLAND, His Grace George Granville, Duke of, K.G. 1813
SUTHERLAND, Her Grace Harriet, Duchess of 1834
†STAFFORD, The Most Noble George Granville William, Marquis of, M.P. 1849
2600 STRATHMORE, The Right Hon. Thos. George, Earl of 1852
†SELKIRK, The Right Hon. Dunbar James, Earl of 1830
SEAFIELD, The Right Hon. John Charles, Earl of 1842
SOUTHESK, The Right Hon. James, Earl of 1850
STAIR, The Right Hon. North, Earl of 1843
†STRATHALLAN, The Right Hon. William Henry, Viscount 1847
SALTOUN, The Right Hon. Alexander, Lord 1854
SINCLAIR, The Right Hon. Charles, Lord 1829
SCOTT, The Right Hon. Lord John 1833
STUART, The Right Hon. Lord James 1819
2610 SYLVESTRE, The Baron de, Paris, Honorary Associate 1836
STUART, The Hon. John 1824
STUART, The Hon. Charles Francis 1826
SANDILANDS, The Hon. James, Barnton 1855
SETON, Sir William Coote, of Pitmedden, Bart. 1834
SINCLAIR, Sir John Gordon, of Stevenson and Murkle, Bart. 1832
STEWART, Sir Michael Robert Shaw, of Blackhall and Ardgowan, Bart., M.P. 1848
SINCLAIR, Sir George, of Ulbster, Bart. 1812
SCOTT, Sir William, of Ancrum, Bart. 1829
STEWART, Sir Wm. Drummond, of Grandtully, Bart. 1839
2620 SUTTIE, Sir George Grant, of Balgone and Preston-grange, Bart. 1839
SINCLAIR, Sir John, of Dunbeath, Bart. 1824
STEUART, Sir Henry M. Seton, of Allanton and Touch, Bart. 1835
STEWART, Rear-Admiral Sir Houston, of Gart 1822
Sadler, Thomas, Norton Mains, Ratho 1838
Sadler, William, Ferrygate, Dirleton 1853
Salmon, Henry, of Bonnyside, Banker, Falkirk 1834
Salmon, John, Johnstone Castle, Johnstone 1856

		Admitted
	Salmond, Duncan, Rothesay	1846
	Salmond, Robert, Banker, Glasgow	1845
2630	Sanderson, Captain Archibald, of Glenlaggan	1844
	Sanderson, James, junior, Meigle, Galashiels	1854
	Sandford, Erskine Douglas, Advocate, Steward of the Stewartry of Kirkcudbright	1827
	Sands, William John, W.S.	1849
	Sang, Edward, Kirkcaldy	1855
	Sangster, Robert B., Banker, Golspie	1845
	Sawers, Alexander S., of Newhouse, Dunbar	1850
	Scarth, James, Banker, Leeds	1828
	Scarth, Robert, of Binscarth	1843
	Sceales, Andrew, Blackburn House, Linlithgow	1828
2640	Sclanders, Alexander, George Street, Edinburgh	1854
	Scobie, John, Lochinver, Golspie	1851
	Scoon, Kenneth, Castleton, Gorebridge	1854
	Scot, William, of Craigmuie	1838
	Scotland, John, London	1835
	Scott, Adam, Dalmore, Ross-shire	1851
	Scott, Alexander, Beanston, Prestonkirk	1850
	Scott, Alexander, Craiglockhart, Slateford	1844
	Scott, Andrew, Glendouglas, Jedburgh	1848
	Scott, Carteret G., of Malleny	1842
2650	Scott, Charles, Palmerton, Cockburnspath	1857
	Scott, Charles C., of Hawkhill	1831
	Scott, David	1823
	Scott, David, of Brotherton	1849
	Scott, David, Northfield, Portobello	1849
	Scott, Captain George, of Wooden	1844
	Scott, Lieutenant-Colonel George, Edinburgh	1821
	Scott, Henry, Crosslee, Selkirk	1853
	Scott, Hugh, of Gala	1846
	Scott, James, of Kelly, Glasgow	1850
2660	Scott, James Fitzmaurice, of Commieston	1843
	Scott, James R. Hope, of Abbotsford	1854
	Scott, John, Dunbeath Mains, Dunbeath	1850
	Scott, John, Finnart House, Greenock	1826
	Scott, John, W.S.	1842
	Scott, Captain Robert	1841
	Scott, Thomas, Beal, Berwick-on-Tweed	1855
	Scott, Thomas, of Beechwood	1843
	Scott, Thomas, London	1850
	Scott, Thomas M'Millan, yr. of Wauchope	1843
2670	Scott, Thomas Rennie, Castle Mains, Douglas	1827
	Scott, Walter, Glendronach, Huntly	1850

		Admitted
	Scott, William, Teviot Bank, Hawick	1853
	Scott, William, Wester Rora, Mintlaw	1855
	Scott, William, Mossilee, Galashiels	1855
	Scott, William, North Leys, Banchory	1857
	Scott, William Inglis, Merchant, Glasgow	1850
	Sellar, Patrick Plenderleith, Morvich, Golspie	1849
	Sempill, Edward, Dunedin, Murrayfield	1856
	Seton, Alexander, of Preston	1854
2680	Seton, George, Advocate	1848
	Shairp, Major Norman, of Houston	1823
	Shand, John, W.S.	1844
	Shand, Robert, Advocate, Aberdeen	1840
	Sharp, James	1846
	Sharp, Thomas, Manufacturer, Paisley	1839
	Shaw, Alexander Nesbitt, Newhall, Fortrose	1856
	Shaw, Charles, W.S., Sheriff-Substitute, Lochmaddy	1835
	Shaw, David, W.S., Ayr	1836
	Shaw, Hary, junior, Bogfairn, Tarland	1850
2690	Shaw, Patrick, Advocate, Sheriff of Chancery	1835
	Shawe, R. F., of Bartinghame Thorpe, Hull	1838
	Shennan, James, Balig, Kirkcudbright	1857
	Shepherd, George, Shethin, Tarves	1854
	Shepherd, James, W.S.	1828
	Shirreff, Charles, Sheriff-Substitute, Dunfermline	1829
	Shirreff, David, Viewfield, Inverness	1837
	Shirriff, David, Muirton, Drem	1847
	Shirriff, Samuel D., Saltcoats, Haddington	1850
	Shortreed, Robert, Altonburn, Yetholm	1854
2700	Sidey, James, Pitcairngreen, Perth	1852
	Sim, Adam, of Coulter Mains	1836
	Simpson, Alexander, Teawig, Beauly	1846
	Simpson, Alexander, Downduff, Forres	1855
	Simpson, Alexander Horatio	1830
	Simpson, George, Bedrule, Jedburgh	1853
	Simpson, James Y., M.D., Professor of Midwifery, University of Edinburgh	1848
	Simpson, James, Mawcarse, Kinross	1851
	Simpson, Robert, of Cobairdy	1839
	Simpson, Thomas H., Gortinlee, Lasswade	1855
2710	Simpson, William, of Glenythan, Aberdeen	1835
	Simson, Charles, of Threepwood, Lauder	1850
	Simson, George, of Pitcorthy	1841
	Simson, James, Secretary of the Melrose Farmer's Society, Melrose	1852
	Simson, Thomas, Blainslie, Lauder	1850

		Admitted
	Sinclair, A exander, H.E.I.C.S., Edinburgh	1839
	Sinclair, Dugald, Kilchmaig, Tarbert	1826
	Sinclair, James, of Forss	1830
	Sinclair, John, of Lochaline	1834
	Sinclair, John, Borlum, Drumnadrochit	1856
2720	Sitwell, Major William H., Sydenham, Kent	1845
	Siveright, James	1850
	Skelton, George, of Invernettie Lodge	1837
	Skene, George, younger of Rubislaw	1831
	Skene, Moncreiff, younger of Pitlour	1849
	Skene, Patrick George, of Hallyards	1825
	Skene, William F., W.S.	1831
	Skinner, Captain C. G. M'Gregor, Belfast	1823
	Skinner, James, Drumin, Ballindalloch	1827
	Skirving, Adam, of Croyes, Dumfries	1857
2730	Skirving, James, Luffness Mains, Haddington	1850
	Skirving, Robert Scot, Campton, Haddington	1846
	Sligo, John, of Carmyle	1826
	Smail, William Archibald, of Overmains	1847
	Small, David, Writer, Dundee	1843
	Small, Patrick, of Dirnanean	1826
	Small, William, Merchant, Dundee	1843
	Smart, George, of Cairnbank, Montrose	1854
	Smart, James, Liberton, Edinburgh	1848
	Smith, Alexander, Civil Engineer, Aberdeen	1847
2740	Smith, Alexander, Engineer, Glasgow	1852
	Smith, Andrew, Blackwood, Lesmahagow	1856
	Smith, Archibald, Sheriff-Substitute, Glasgow	1838
	Smith, Charles, Whittingham, Prestonkirk	1853
	Smith, Charles Hope Johnstone, Garden Architect	1836
	Smith, David, Merchant, Leith	1854
	Smith, David, W.S.	1833
	Smith, E. B., of Blackwood House, Ecclefechan	1839
	Smith, George, Moffat, Surgeon, R.N.	1829
	Smith, George, Minmore, Ballindalloch	1839
2750	Smith, George Campbell, Land-Surveyor, Banff	1837
	Smith, Hugh, Carnwath Mill, Lanark	1854
	Smith, James, Architect, Glasgow	1838
	Smith, James, Lawhill, Auchterarder	1855
	Smith, James, of Jordanhill	1823
	Smith, James, of Olrig	1855
	Smith, John, Harecraig, Dundee	1843
	Smith, John, Advocate, Aberdeen	1851
	Smith, John, Hillhead, Forres	1855
	Smith, John Gordon, Nevie, Ballindalloch	1852

		Admitted
2760	Smith, John T., Goswick, Berwick-on-Tweed	1854
	Smith, Major Hope, of Cruicksfield, Dunse	1853
	Smith, Robert, Edinburgh	1839
	Smith, Robert, Kersquarters, Kelso	1854
	Smith, Robert, Ladyland, Dumfries	1850
	Smith, R. M., Merchant, Leith	1854
	Smith, Thomas, Banker, London	1798
	Smith, Thomas, Dalfibble, Lochmaben	1850
	Smith, William, Cattle Salesman, Edinburgh	1854
2770	Smith, William, East Learmonth, Coldstream	1854
	Smith, William, of Carbeth-Guthrie	1823
	Smith, William, Line, Ballindalloch	1857
	Smith, William, jun., West Drums, Brechin	1856
	Smyth, Alexander, Drumduan, Forres	1855
	Smythe, William, of Methven	1846
	Smollett, Alexander, of Bonhill, M,P.	1826
	Somervail, Peter, Glendevon, Linlithgow	1857
	Somerville, James, Merchant, Glasgow	1838
	Somerville, James, Ladyurd, Kirkurd	1848
2780	Somerville, Samuel, of Ampherlaw, M.D., Edinburgh	1841
	Somerville, Samuel H. May, of Broadfield	1845
	Somerville, Thomas, of Greenfield	1845
	Somerville, William, Merchant, Glasgow	1850
	Souter, Alexander, Secretary, Banffshire and Turriff District Agricultural Association, Banff	1854
	Souter, David Robertson, Edinburgh	1847
	Souter, Francis George, Edinburgh	1840
	Speid, James, of Forneth	1843
	Speir, Thomas, of Blackston	1838
	Speirs, Archibald, H.E.I.C.S., Cowden Hill, Dollar	1852
2790	Speirs, Thomas Dundas, Burnfoot	1838
	Spens, Nathaniel, of Craigsanquhar, W.S.	1848
	Spens, William, Glasgow	1845
	Spooner, Lucius Henry, Munlochy	1850
	Spottiswoode, John, of Spottiswoode	1812
	Sprot, James, of Spot	1830
	Sprot, John, Edinburgh	1830
	Sprot, Mark, of Garnkirk	1820
	Sprot, Mark, of Riddell	1830
	Sprot, Thomas, W.S.	1826
	Stables, William Alexander, Cawdor Castle, Nairn	1836
2800	Starforth, John, Architect, Edinburgh	1854
	Stark, William, of Easter Camps, Ratho	1855
	Stedman, James, Banker, Jedburgh	1851
	Steedman, James, Boghall, Roslin	1847

		Admitted
	Steel, Samuel, of Waygateshaw	1849
	Steele, Robert, of Knock Castle	1853
	Steele, William, Sheriff-Substitute of Dumbarton	1828
	Stegmann, Conrad, Merchant, Leith	1854
	Stenhouse, George, West Pilton, Blackhall	1850
	Stenhouse, James, Southfield, Corstorphine	1850
2810	Stenhouse, James, younger of Northfod	1852
	Stenhouse, John, Quarryford, Gifford	1855
	Stephen, William, Inchbroom, Elgin	1853
	Stephens, Henry, Redbrae Cottage, Edinburgh	1826
	Steuart, Andrew, of Auchluncart	1845
	Steuart, Archibald Seton, Alloa	1835
	Steuart, Claud Scott, Dalguise	1843
	Steuart, James, W.S.	1842
	Steuart, Robert, of Carfin	1833
	Steuart, Robert, of Parsons Green, Glasgow	1844
2820	Steuart, William, London	1833
	Stevens, John, New Mills, Dalkeith	1855
	Stevens, Moses, of Bellahouston	1832
	Stevenson, Alexander, Banker, Langholm	1839
	Stevenson, Alexander, S.S.C.	1813
	Stevenson, Andrew, United States, Honorary Associate	1839
	Stevenson, Andrew, Duncanland, Gifford	1855
	Stevenson, Charles, Edinburgh	1850
	Stevenson, David, C.E., Edinburgh	1853
2830	Stevenson, David, Newburnshot, Cramond	1851
	Stevenson, Duncan, Carlton Street, Edinburgh	1824
	Stevenson, Captain Hugh	1805
	Stevenson, John, Oban	1842
	Stevenson, John B., Westfield, South Queensferry	1853
	Stevenson, Thomas, Mount-Lothian, Penicuik	1853
	Stewart, Alexander, Dalvey, Grantown	1852
	Stewart, Captain Dugald	1799
	Stewart, Charles, Aberfeldy	1834
	Stewart, Charles, of Ardsheal	1846
	Stewart, Charles, of Hillside	1823
2840	Stewart, Charles, Solicitor, Inverness	1840
	Stewart, David, London	1842
	Stewart, George, Kirkchrist, Kirkcudbright	1844
	Stewart, Henry, of St Fort	1837
	Stewart, Henry Black, of Balnakiely	1838
	Stewart, James, Pitskelly, St Martins, Perth	1851
	Stewart, James, New Market, Aberdeen	1854
	Stewart, Rev. James, Abernethy, Grantown	1856

		Admitted
	Stewart, John, of Belladrum	1819
	Stewart, John, of Dalguise	1823
2850	Stewart, John, of Findynate, M.D., R.N.	1839
	Stewart, John, of Nateby Hall, Lancashire	1851
	Stewart, John, of Cardross, Dumbarton	1851
	Stewart, John, Strathaven	1854
	Stewart, John, Upper Ardroscadale, Rothesay	1855
	Stewart, John Lorn, of Coll	1824
	Stewart, Mark S., of Southwick	1837
	Stewart, Robert, of Ballechin, Dunkeld	1854
	Stewart, Robert, younger of Drumore Campbeltown	1855
	Stewart, Robert Hathorne Johnstone, of Straiton	1846
2860	Stewart, Samuel, Sandhole, Strichen	1857
	Stewart, Stair Hathorn, of Physgill	1828
	Stewart, Thomas, Carterhaugh, Selkirk	1852
	Stewart, William, Sheriff-Clerk, Kincardineshire	1825
	Stewart, William, Ballaterach, Ballater	1829
	Stewart, William, of Blackhouse, Largs	1844
	Stewart, William, of Shambellie	1845
	Stewart, William, Tonroich, Campbeltown	1850
	Stirling, James, C.E., Edinburgh	1852
	Stirling, John, of Kippendavie	1833
2870	Stirling, J. D. Morris, of Blackgrange	1841
	Stirling, Thomas Graham, of Strowan	1839
	Stirling, William, of Content	1823
	Stirling, William, of Keir, M.P.	1841
	Stirling, William, junior, Kenmuir	1855
	Stobie, Thomas, Balneithill, Kinross	1851
	Stodart, Archibald, Covington, Biggar	1855
	Stodart, David, Jerviswood Mains, Lanark	1855
	Stodart, George Tweedie, of Oliver, W.S.	1839
	Stodart, James, Walston, Carnwath	1855
2880	Stodart, James, Drumelzier, Rachan Mill	1855
	Stodart, John, Muirhouse, Carnwath	1851
	Stodart, William, Chesterhall, Biggar	1855
	Stoddart, Alexander, Ballendreck	1829
	Storrie, Francis, V.S., East Linton	1850
	Story, John, Merchant, Leith	1851
	Stott, Gibson, Edinburgh	1832
	Stott, John, Netherwood, Dumfries	1855
	Strachan, Ralph, Crosshouse, Milton Bridge	1853
	Straton, George Thomas, of Kirkside	1842
2890	Stronach, William, Ardmellie, Huntly	1840
	Stuart, Captain John	1809

		Admitted
	Stuart, Samuel M'Dowall, Glasgow	1845
	Sturrock, John, Banker, Dundee	1843
	Sutherland, Eric, Shempston, Elgin	1853
	Sutherland, George, of Forse	1849
	Sutherland, Joseph, Shiness, Lairg	1856
	Sutherland, Robert, Shiness, Lairg	1856
	Sutherland, Sinclair, New Pitsligo	1852
	Suttie, James, Newmains, Inchture	1855
2900	Swan, John, Cattle Salesmen, Edinburgh	1851
	Swan, Robert, Writer, Kelso	1852
	Swinburne, Colonel T. R., of Marcus	1843
	Swinton, Arch. Campbell, yr. of Kimmerghame	1841
	Swinton, John Campbell, of Kimmerghame	1810
	Sydserff, Thomas Buchan, of Ruchlaw	1853
	Syme, James, Professor of Clinical Surgery, University of Edinburgh	1838
	Syme, Robert, Couston, Dalgetty, Aberdour	1854
	Symers, Colin, of Kingskettle	1843
	Symington, Thomas	1848
2910	†TWEEDDALE, Most Noble George, Marquis of, K.T.	1809
	TRAQUAIR, The Right Honourable Charles, Earl of	1811
	TORPHICHEN, The Right Hon. James, Lord	1821
	TORPHICHEN, The Hon. Robert Sandilands, Master of	1831
	THRIEPLAND, Sir Patrick Murray, of Fingask, Bart.	1824
	Tait, Alexander D., of Millrig	1845
	Tait, George, Advocate	1808
	Tait, James, Banker, Kelso	1846
	Tait, John, Sheriff of Kinross and Clackmannan	1834
	Tait, Joseph, Brankanentham, Portsoy	1852
2920	Tawse, John, Advocate	1825
	Taylor, Farquharson, Wellhouse, Aberdeen	1850
	Taylor, Malcolm, Ardnadam, Dunoon	1853
	Taylor, Robert, Dumfrennie, Banchory	1857
	Taylor, William, North Queensferry	1828
	Telfer, Alexander Bell, Cunning Park, Ayr	1852
	Tennant, Charles, of the Glen	1853
	Tennant, Charles J., St Rollox, Glasgow	1838
	Tennant, Hugh, of Wellpark, Glasgow	1838
	Tennant, John, of St Rollox	1833
2930	Thew, Edward, Shortridge House, Alnwick	1855
	Thoms, Alexander, of Rumgay	1842
	Thomas, James, Forthar, Kettle	1855
	Thompson, Andrew, Berwick-on-Tweed	1845
	Thompson, John, Paston, Coldstream	1856

		Admitted
	Thompson, Richard, Cheswick East House, Northumberland	1854
	Thomson, Alexander, of Banchory	1821
	Thomson, Alexander, Banker, Greenock	1825
	Thomson, Alexander, of Whiterig	1838
	Thomson, Arthur, Banker, Aberdeen	1841
2940	Thomson, George, of Burnhouse	1836
	Thomson, George, The Catterick Forest, Yorkshire	1854
	Thomson, Henry Sinclair, The Manse, Penicuick	1854
	Thomson, James, Papple, Haddington	1828
	Thomson, James, Mungoswalls, Dunse	1855
	Thomson, John, Banker, Edinburgh	1833
	Thomson, John Anstruther, of Charleton	1848
	Thomson, Peter, Peffermill, Liberton	1849
	Thomson, Robert, Advocate, Sheriff of Caithness	1835
	Thomson, Robert John, Haningside, Linlithgow	1852
2950	Thomson, Thomas, Merchant, Glasgow	1850
	Thomson, Dr William, of Quocies, Stonehaven	1849
	Thomson, William, of Balgowan	1844
	Thomson, William, Grain Merchant, Edinburgh	1854
	Thomson, William Thomas, Edinburgh	1841
	Threshie, David Scott, W.S.	1824
	Threshie, Robert, of Barnbarroch	1835
	Timins, William, of Hillfield, Stanmore, Middlesex	1844
	Tindal, James, Stonehaven	1849
	Tod, George, Lochran, Blair-Adam	1851
2960	Tod, George, Gorgie Mains, Edinburgh	1854
	Tod, Hugh, W.S.	1817
	Tod, Peter, of Meikleholmside	1829
	Tod, Robert, Cardrona, Noblehouse	1853
	Tod, William, Gospetrie, Kinross	1851
	Tod, William, Cattle Agent, Edinburgh	1851
	Tod, William, Elphinstone Tower, Tranent	1852
	Todd, John, of Finnich, Dumbarton	1838
	Todd, Peter, Burican, Arran	1844
	Torrance, George M'Micken, of Threave	1827
2970	Torrance, Thomas, Meadowhead, Liberton	1831
	Torrance, William, Gilmerton	1831
	Torrie, Thomas Jameson, Advocate	1837
	Traill, George, of Ratter, M.P.	1822
	Traill, Thomas Stewart, of Tirlot, M.D., Professor of Medical Jurisprudence, University of Edinburgh	1834
	Traill, William, of Woodwick, Orkney	1821

Admitted

Traquair, Ramsay H., Colinton 1846
Trench, Henry, of Cangort Park, Shinrone, Ireland 1857
Trotter, Archibald, of the Bush and Castlelaw 1845
Trotter, Charles, of Woodhill 1841
2980 Trotter, John P., Sheriff-Substitute, Dumfries 1831
Trotter, Richard, of Mortonhall 1836
Trotter, Robert Knox, of Ballindean 1829
Tudhope, George, Colinhill, Strathaven 1850
Turnbull, Alexander, of Dykethead 1854
Turnbull, Archibald, of Bellwood 1826
Turnbull, John, North Bridge, Edinburgh 1855
Turnbull, J. J., Merchant, Leith 1854
Turnbull, John, of Abbey St Bathans, W.S. 1844
Turnbull, John, Spittal, Hawick 1842
2990 Turnbull, Joseph, Bonhill Place, Dumbarton 1838
Turnbull, Phipps, Crooks, Coldstream 1841
Turnbull, Robert, Falnash, Hawick 1854
Turnbull, Stewart, Bonhill Place, Dumbarton 1850
Turnbull, William, Falnash, Hawick 1855
Turner, Angus, Town-Clerk, Glasgow 1844
Turner, Duncan, Corachaine, Dunoon 1853
Turner, Major-General George, of Menie 1828
Turner, John, of Turnerhall 1853
Turner, Peter, Haggs, Ratho 1855
3000 Turner, Richard, Broompark, Ratho 1855
Turner, Thomas, Northrigg, Haddington 1855
Tweedie, David, Castle Crawford, Abington 1853
Tytler, James, of Woodhouselee 1840

Urquhart, Beauchamp Colclough, of Byth 1834
Urquhart, William Pollard, of Craigston, M.P. 1851
Usher, John, Stodrig, Kelso 1853

Vallentine, James, Woodmyre Cottage, Brechin 1850
Veitch, James, of Elliock 1822
Veitch, Christopher, Bridgend, Linlithgow 1853
3010 Vere, Charles E. Hope, Craigiehall 1856
Vere, W. E. Hope, of Craigiehall and Blackwood 1846
Vernor, James A., Hillhead, Musselburgh 1829

†Wemyss, The Right Hon. Francis, Earl of 1819
†Willoughby d'Eresby and Gwydir, The Right Honourable P. Drummond Burrell, Lord 1808
Ward, The Right Honourable William, Lord 1843
Walpole, The Honourable Henry, Wolterton Park 1845
Waddell, William, of Easter Moffat, W.S. 1818

		Admitted
	Waldie, John, Kelso	1824
	Waldie, John, of Henderside	1826
	Waldie, James, Millisle, Garlieston	1855
	Walker, Alexander, Brightmony, Nairn	1855
	Walker, A. R., Wester Fintray, Keith Hall	1854
	Walker, Bethune James, of Fallfield	1835
3030	Walker, Charles, Drumblair, Huntly	1847
	Walker, Francis, Craignetherty, Turriff	1857
	Walker, J. W., Ravensnook, Penicuik	1856
	Walker, James, of Blairton	1847
	Walker, James, Kilpunt, Broxburn	1854
	Walker, John, of Crawfordton	1834
	Walker, John, W.S.	1848
	Walker, Matthew, Glasgow	1844
	Walker, Robert, Montbletton, Banff	1853
	Walker, Robert, Lathamhill, Barony	1844
3040	Walker, Robert, Mains of Portlethen, Aberdeen	1847
	Walker, Robert, Leuchars House, Elgin	1854
	Walker, Dr Thomas, of Polmont Bank	1843
	Walker, William S., of Bowland	1835
	Walker, William, Inner Avon, Polmont	1854
	Wallace, David, Balgrummo, Leven	1852
	Wallace, William of Auchinvole	1844
	Walrond, Theodore, of Calder Park	1850
	Wardlaw, Major James, Lancashire Rifles	1856
	Wason, Rigby, of Corwar	1836
3050	Waterston, Charles, Banker, Inverness	1839
	Watson, Crawford, Netherton of Logie, Peterhead	1855
	Watson, George, Dalkeith Park	1854
	Watson, George, Liberton Mains, Edinburgh	1848
	Watson, Henry George, Accountant, Edinburgh	1841
	Watson, Hugh, Keillor, Coupar-Angus	1828
	Watson, John, Manager of the Edin. Gas-Light Co.	1825
	Watson, John, junior, Over Johnston, Motherwell	1857
	Watson, Peter, Campbeltown	1847
	Watson, R. H., Bolton Park, Cumberland	1852
3060	Watson, Thomas, Esperston, Fushie Bridge	1852
	Watson, William, Keillor, Coupar-Angus	1852
	Watson, William, of Burngrove	1841
	Watt, James, Secretary Biggar Farmers' Club,	1856
	Wauchope, Andrew, of Niddrie Marischall	1840
	Wauchope, John, of Edmonstone	1842
	Waugh, Robert, Carlogie, Dundee	1850
	Webster, James, S.S.C., Edinburgh	1853
	Webster, James, Kinneil, Bo'ness	1853

		Admitted
	Webster, John, Thankerton, Holytown	1839
3070	Webster, Robert, Gavel House, Kilsyth	1856
	Webster, William, Islay	1838
	Wedderburn, David, of Pearsie	1831
	Wedderburn, Frederick L. S., of Wedderburn	1844
	Weems, Robert, of Kirkennan	1848
	Weir, Thos. Graham, of Tollcross, M.D., Edinburgh	1849
	Welsh, Alexander, Spott, Dunbar	1850
	Welsh, David, of Collin, W.S.	1830
	Welsh, David, Tillytoghills, Brechin	1855
	Welsh, Thomas, of Earlshaugh, Moffat	1853
3080	Welwood, Alexander Maconochie, of Garvoch, Treasurer of the Society	1800
	Welwood, Allan A. Maconochie, yr. of Garvoch	1842
	Wemyss, Dr Alex. Watson, of Denbrae, St Andrews	1851
	Wemyss, David Sinclair, of Southdun	1846
	Wemyss, James, of Wemyss Hall	1841
	Wemyss, James Hay Erskine, of Wemyss	1854
	Wetherell, William, Land Agent, Durham	1836
	White, Alexander, of Fens, Merchant, Leith	1829
	White, George, Bridgend of Auchlee, Mintlaw	1851
	White, Henry W., of Monar	1842
3090	White, James, Royal Terrace, Edinburgh	1842
	White, John, of Drumelzier	1842
	White, John, Harthill, Secretary, Whitburn Agricultural Society	1853
	White, Peter, Accountant, Glasgow	1838
	White, Robert, W.S.	1842
	White, Thomas, of Glenesslyn	1829
	White, William, Merchant, Glasgow	1838
	White, William, of Dykehead, Carnwath	1854
	White, William Logan, of Keillerstain, Hermiston	1856
	Whitehead, Joseph, younger of Kilnside	1845
3100	Whittet, George, Whitehouse, Cramond	1850
	Whitton, Andrew, of Couston	1843
	Whyte, John, Ballochoyle, Dunoon	1853
	Wight, David, W.S.	1854
	Wightman, James Seton, of Courance	1827
	Wilkie, Duncan, Kirriemuir	1843
	Wilkie, John, of Foulden	1830
	Wilkie, William, of Bonnington	1824
	Willbank, Jonas, Keighley, Yorkshire	1854
	Williamson, Donald, Banker, Tain	1847
3110	Williamson, George, Auldtown of Carnousie, Turriff	1850
	Williamson, James, Newton of Mounblairy, Banff	1853

		Admitted
	Williamson, James, of Banniskirk, Thurso	1857
	Williamson, John, Veterinary Surgeon, Edinburgh	1848
	Williamson, John W., of West Green, Kinross	1829
	Willis, Thomas, Manor House, Carperby	1854
	Wilson, Alexander, Kilnhilloch, Cullen	1842
	Wilson, Alexander, Forehouse, Kilbarchan	1854
	Wilson, Alexander, Fetterletter, Fyvie	1854
	Wilson, Andrew, Waterside of Forbes, Aberdeen	1850
3120	Wilson, David, of Inchrye Abbey, Newburgh	1848
	Wilson, David, Halls, Penicuik	1854
	Wilson, George, Dalmarnock, Glasgow	1847
	Wilson, George, M.D., Professor of Technology, University of Edinburgh	1845
	Wilson, George, Mills of Drum, Banchory	1857
	Wilson, James, Auchaleck, Campbeltown	1848
	Wilson, James, Banker, Inverness	1840
	Wilson, James, Wester Cowden, Dalkeith	1848
	Wilson, James, Glasgow	1844
	Wilson, James, Burnetland, Biggar	1854
3130	Wilson, John, of Auchineden	1835
	Wilson, John, Eastfield, Penicuik	1848
	Wilson, John, of Cumledge	1841
	Wilson, John, Edington Mains, Ayton	1851
	Wilson, John, Billholm, Langholm	1850
	Wilson, John, Professor of Agriculture in the University of Edinburgh	1855
	Wilson, John, Nicolton, Polmont	1855
	Wilson, John C., Prinlaws, Markinch	1852
	Wilson, Robert Sym, of Woodburn	1841
	Wilson, Robert, Durn, Portsoy	1852
3140	Wilson, Robert, Firthfield, Anstruther	1852
	Wilson, William, Kinneil Iron Works, Bo'ness	1853
	Wilson, William, Shaw Farm, Windsor	1853
	Wilson, William, W.S.	1849
	Wilson, William, Writer, Inverary	1853
	Wilson, William, Gateside, Uphall	1853
	Wilson, William, Wester Brathins, Banchory	1857
	Wilsone, George Ross	1826
	Wingate, Andrew, Merchant, Glasgow	1838
	Wishart, Edward, Merchant, Leith	1855
3150	Wood, John, Colinsburgh	1835
	Wood, J. Stewart	1844
	Wood, William, Merchant, Leith	1828
	Wood, William E. Collins, of Keithock	1841
	Woodman, William, Town-Clerk of Morpeth	1856

		Admitted
	Wooley, Richard, Spittal, Berwick-on-Tweed	1821
	Wright, Andrew, Corstorphine	1853
	Wright, David, Southfield, Gladsmuir	1850
	Wright, James, of Lawton	1817
	Wright, James, Glasgow	1839
3160	Wright, James, Secretary, Royal Bank, Edinburgh	1853
	Wright, John B., Hedderwick Hill, Dunbar	1848
	Wyld, James, of Gilston	1802
	Wylie, David, Circuit-Clerk of Justiciary, Edinburgh	1825
	Wylie, George, of Arndean, Dollar	1857
	Wylie, William Macfarlane, Brucefield, Mid-Calder	1850
	Wyllie, James F., Bolfracks, Aberfeldy	1833
	Wyllie, James Bloom, Mid-Calder	1852
	Wyllie, James, Mains of Edzell, Edzell	1854
	Wyllie, John, New Farm, Mid-Calder	1849
3170	Wyllie, W. A., Ninewar, Prestonkirk	1855
	Yeats, William, of Aquharney, Advocate, Aberdeen	1838
	Young, Alexander, Keir Mains, Dunblane	1852
	Young, George, Sheriff of Inverness	1854
	Young, Harry, of Cleish Castle, Kinross	1842
	Young, James, of Gallowhill	1852
	Young, James, Land-Surveyor, Perth	1841
	Young, James, Broadholm, East Kilpatrick	1856
	Young, John, Niddry, Winchburgh	1852
	Young, Joseph, Grange, Burntisland	1848
3180	Young, Samuel D.	1826
	Young, Captain William Baird, of Ascreavie	1852
	Young, William S.	1821
	Yuille, Andrew Buchanan, of Darleith	1838
	Yule, Colonel Patrick, Royal Engineers	1827
	Yule, Thomas B., Merchant, Leith	1852
	ZETLAND, The Right Hon. Thomas, Earl of	1840